

A Review on Solar Based Wireless Farming Sensors

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ABSTRACT: Wireless Sensor Network are mainly an autonomous sensor which are placed in the field to detect and observe physical and environmental conditions and parameters like temperature, soil moisture, soil ph. Sensors are mainly deployed in an adverse and non-accessible areas therefore energy conservation plays a vital role for these networks. The wireless sensor nodes which are placed in the field will collect the real-time data and transfer it to the base station using multiple protocols. The data collected at the base station will be used to check different parameters such as soil moisture, humidity, soil temperature and eventually take the necessary decisions based on that. This paper mainly focuses on utilizing solar power as it provides an unlimited energy resource and on the other hand focuses on routing protocols used for the communication between the sensor nodes. WSN technology will mainly benefit in the field of agriculture to increase the yield of crops.

KEYWORDS: WSN, precision agriculture, routing protocol, energy conservation, solar power, soil moisture, soil temperature, humidity.

I. INTRODUCTION

Various tools and technologies are required nowadays to increase the efficiency and the quality of the crop production and reduce the environmental effect on the production of the crop in the field of precision agriculture. Precision agriculture is explained as applying the right amount of input at right location on right time to get adequate amount of quality production. Precision agriculture is based on various technologies like Global Positioning System, Geographic Information System, and various production monitoring. Wireless sensor network technologies are entering a new era with a rapid advancement and providing vast opportunities in the field of research and development. WSN operates at a large scale in the field of agriculture and is significant with respect of cost, size, power, flexibility when compared to that of wired technology [1]. Routing in wireless sensor network takes place in the presence of very limited resources of the nodes. Assumption made up till now is that all the nodes in the sensor network consume battery power for communication but on the other hand energy sources such as solar energy, wind, and hydro energy of which solar energy will prove highly beneficial for communication i.e. receiving and transferring of packets between the nodes [2]. A WSN system is a collection of nodes which comprises of radio frequency transceivers, microcontrollers, amplifiers, and power sources [1]. Routing of packets via solar powered nodes is highly feasible and conserves energy at a greater extent.

The simulation shows the working of multiple protocols which we therefore called solar aware routing protocols that mainly route the packets via solar powered nodes. One of the protocols is the simplified and standardized version of directed diffusion, where the nodes local interact with the adjacent nodes. Basically, it works on a small scale; on the other hand the other protocol works on a large area. The later protocol is an extended version of directed diffusion. In the simulation performed the results show that directed diffusion is more beneficial and suited for small sensor network whereas on the other hand the second protocol performs more efficiently on large network. The solar aware protocol is efficient for small scale area because it has less overhead of the message transmission. The hardware that will be used

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while creating the module comprises of different sensors: a light sensor for detection of visible light, an infrared sensor for tracking the movement, temperature sensor to check the temperature of the soil, humidity sensor and soil moisture sensor, processing unit, power unit, and radio transceiver. The radio transceiver helps for the communication among the sensor nodes which is supported by the power and processing unit.

II. PROBLEM STATEMENT

It is seen that the farmers undergo a large amount of loss due to the false estimation of climate conditions, wrong means of carrying out the farming procedure, inappropriate brand and quantity of fertilizer, etc. Now with the aid of wireless farming sensors the farmers can get a suitable knowledge about weather conditions and the type of the soil which will help the farmer to know the appropriate amount of the parameters needed in the precision agriculture. The major problem faced by the farmers today is that they are unaware of the methods needed for farming, poor knowledge regarding soil and based on that how much amount of fertilizers and water content will be needed. In the recent Indian scenario, the farmers are short of soil analysis techniques for irrigating the crops. This is because the analysis of soil increases the cost to build the labs which are used for testing these factors, time, and investment etc. and by delivering a sample of soil will not refer to the entire farm and so the results are not valid.

Therefore, the wireless farming sensor technology helps in solving these kinds of problems that are faced by the farmers resulting in cost effective output. For the favourable outcome of wireless sensor technology, there should be a need for reliable communication between the sensor nodes. The major advantage is that the communication and the processing of the nodes take place by using the unlimited radiant energy emitted by the sun i.e. solar energy which is cost effective. Hence the energy is conserved and there is a great positive impact on the performance [1].

III. LITERATURE REVIEW

In the paper [1] the proposed wireless sensor network uses the power source to exchange the information among the sensor nodes for monitoring in the field of precision agriculture. The wireless communication technology used in this paper is low power ZigBee that supports system automation and monitoring of the crops. The data is accumulated by the wireless sensor nodes and transferred to the base station. The data collected is based on various factors such as humidity, moisture, and temperature. This data is repeatedly studied at the base station and as per the observations and conclusions; the farmers are notified about the methods needed for farming and the content regarding the parameters which help them in increasing the productivity. If the data sent by the sensor exceeds a threshold, then the farmers receive a message on their mobile devices through the GSM cellular network technology to put a hold on their actions. The system overcomes the disadvantages of wired sensor network and provides high capacity, reliable and efficient nodes, it is cost effective and easy to install and remove the nodes.

This paper [2] examined the use of precision farming based on the survey conducted which divided the farmers into three groups namely "users", "planners", "non-users". The users and non-users had almost the same view on the precision farming. The result was concluded based on the hypothesis of three groups perception on the parameters like cost, chemical usage, and quality of crops produced. The outcome helped them to know whether they can accept the precision farming or not.

In the paper [3] how the effective and standard yield production of tomato crop using the Wireless Farming Sensor technology takes place is proposed. The Automated Intelligent System uses the LITE mode technology and provides the real-time supervised system feedback that looks after and monitors the irrigation system very effectively and efficiently. Wireless Sensing Networking for agriculture, utilizes hardware that is equipped with sensor nodes which are accompanied by CC1110 framework embedded on chip that is of low power RF Trans collector and 8051 MCU. The base station used for the WSN networking acts a Web Server. It is very much crystal clear that growth of tomato is highly dependent on the climatic factors i.e., air, soil pH, soil humidity, soil temperature and soil moisture. So, it is very important to supervise few climatic parameters or environment for the better yield of tomato crop production. The framework used in the paper is built from the microcontroller (MC) chip, WSN base station, information gathering

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nodes and sensors.

In the paper [4] the design of the wireless sensor network in adverse and non-accessible area is proposed which has no fixed infrastructure. It has a huge benefit over battery powered sources by utilizing the solar power energy. In this paper judging of two routing wireless sensor network protocols that track the data using solar power energy source is done. The protocols are solar aware protocol and solar aware directed diffusion. The first protocol works on a small-scale area as there is less overhead of the extra messages and it is difficult to find the path where there is more than one hop while the second protocol can work with large scale area.

In the paper [5] a system is represented which takes into consideration the various parameters such as temperature, humidity, pressure, and moisture. This system can be benefited in many fields like environmental, agriculture monitoring. The system mentioned here mainly comprises of the microcontroller, base station, sensor nodes, and mobile devices. The sensor nodes in this paper consist of the sensor, power unit, processor, and radio transceiver. Communication among the sensor nodes and the base station is done with the help of radio transceiver. The WSN data is collected through the sensor nodes and transferred through the networks. This WSN technology is favourable for increasing the mango production and is mainly suitable for Pakistan weather and it has more advantage over the traditional agriculture procedure.

In this paper [6] it describes about the precision farming and their technologies like GlobalPositioning System, Geographic Information System, remote sensing, production monitoring, etc. The paper also describes the various opportunities, challenges and difficulties in implementing this technology. PA benefits the farmer by making them more economically competitive; it supports them with technical functionality in farming, and provides good crop quality. The adoption of precision farming is a learning process which where the information is gathered, simulated and concluded and it is also related to the size of the farm and the means of communication. There are various challenges that are faced by the precision farming due to the complexity it adds on the decision making as there is large amount of information gathered.

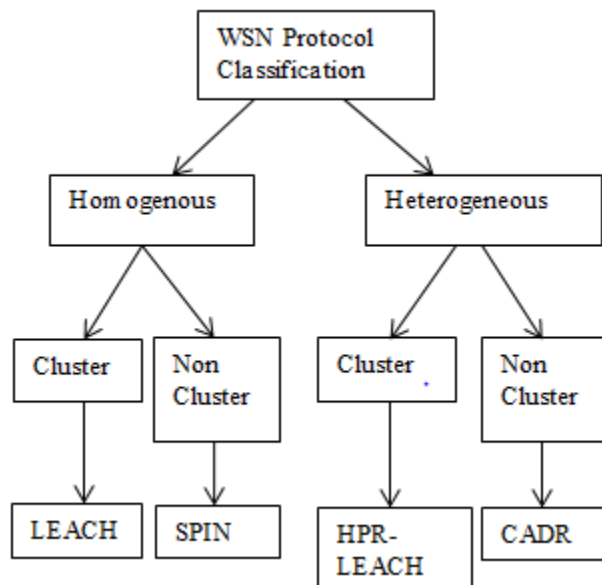


Fig 1 Topology of WSN Protocol

In the paper [7] represents a routing protocol called LEACH. LEACH helps in communication among the sensor nodes which mainly concentrates on energy saving. It provides communication among the local nodes which in turn provides

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scalability and robustness. It also enlightens us on data fusion into the routing protocol that reduces the amount of information that must be transmitted between the base station and the sensor nodes.

In the paper [8] we know that there is need for security measures as there is an increase in the wireless sensor network in near future. This paper mainly describes the various suite of routing protocols for a secure communication, SPINS. SNEPS and μ TESLA are the building blocks of the SPINS. The protocol provides data confidentiality, two-side data authentication and it also controls the resources utilized. With the help of this suite one can also develop and build more advanced protocols.

This paper [9] represents the topology for sensor communication and it also states the difference between the sensor and ad hoc networks. It also tells us about the various design factors, which are fault tolerance, scalability, production cost, hardware constraint, sensor network topology, environment, and transmission media. The different topologies specified for effective radio communication networks are star, mesh, and hybrid. It also describes that there is a huge difference between the previous applications and the emerging technology as the sensors are much more intelligent devices based on their components and interfaces which were used for agro-based industry.

This paper [10] represents an agriculture environment monitoring server system that helps in monitoring the environmental conditions and the crops in farm which includes environmental and soil sensors, Global Positioning System device, CCTV cameras that help image processing. This system gathers the real time data related to the crops using CCTV cameras placed in the farm and aids in monitoring and provides various application based services. The system described here works without any external source of energy as it gains the inefficient energy through the solar cells. Here in this paper there are two prototypes for the implementation and performance evaluation of the designed system. The first prototype did not result as planned as it consumed lot of energy source produced by the solar cell device. To overcome the disadvantages of initial prototype the advanced version was built that had low power embedded board devices and it worked significantly well.

This paper [11] represents the Multipath On-demand Routing (MOR) protocol that is particularly designed for reliability layer and active route management that mainly increases the throughput and energy utilization. It uses local retransmission of the packets among the local nodes which results in decreasing the amount of end to end retransmission, which increases the efficiency. The reliability layer and active route management takes effective steps that ignores the packets that are to be discarded and it rebuilds the route based on routing tables of nodes and also reverse the routes of data that is been forwarded which results in less congestion and flooding.

This paper [12] represents the techniques of directed diffusion protocol used for the communication and transmission of messages among the nodes. The paper has compared the versions and types of directed diffusion protocols based on various parameters like energy, efficiency, lifetime, applications, data transmission, reliability, mobility, and security. There are mainly two important functions of the sensor nodes that are data gathering and transmission and data aggregation. Security is an important factor in both the functions of sensor nodes and it is challenging as security can sometimes be mishandled.

IV. PROPOSED WORK

Before the existence of Precision agriculture, farmers had to mainly depend on information collected through satellite to accurately target their growing areas. The scope of the paper is to give accurate information for the farmers so that the device will help them to gather details about soil and various other parameters which are beneficial for increasing the cultivation. Precision Agriculture gives precise information in both the size of the crop area it governs as well as in the delivery amounts of water, fertilizer, etc. The technology can monitor not only a single plant but typically an area in the tens or hundreds of square feet. We aim to create a device which will use solar energy as a source that will help the farmers gain most likely and fairly exact information about the quality of the soil which in return will increase the productivity by reducing the cost and labor work.

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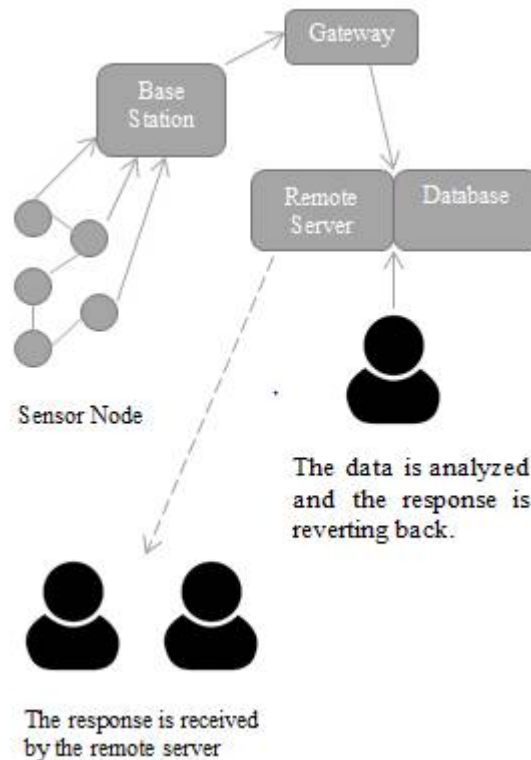


Fig 2 Architecture of Wireless Sensor Network

The database will be containing the predefined values which are suitable for increasing the productivity. The information collected from the field will be compared with the different parameters from the database values and then necessary steps will be taken and finally the farmers will be made aware as to what steps need to be taken by them to increase the productivity. The main advantages of this technology are improvement in production efficiency, product quality, post-harvest operations, and will also reduce environmental impact. The newly evolved wireless sensor network (WSN) technology has spread briskly into various fields. Wireless Sensor Network technology have been recently adopted by Agriculture and farming industries, which will be mainly profitable technology needed to promote its production and motivate the agriculture yield standard. By constant governing and monitoring of the individual crop, farmers can easily identify the various fertilizers, irrigation and other requirements.

V. CONCLUSION

WSN has been majorly benefiting smaller farms, micro-farms and urban farms for crop irrigation. WSN technology makes it possible to focus and monitor each crop regardless of the growing areas. It imitates the human intelligence capability of sensing on a wider range. Another advantage of WSN is cost effectiveness. It mainly reduces the manual labor work required in monitoring the crops. The parameters (moisture, temperature, soil pH) are effectively sensed by the wireless sensors and the data is sent to the remote area servers. The power source utilized here is the solar energy and thus energy is conserved. The data sent at the server side will be interpreted by the DBA engineers and the necessary decisions regarding crop productivity will be taken.

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