International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463
Vol. 3 Issue 4, April-2014, pp: (480-483), Impact Factor: 1.252, Available online at: www.erpublications.com.

Wireless Sensor Network System (WSNS) for Agricultural Practices- A Review

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Abstract: The evolution of wireless sensor network technology has enabled us to develop advanced systems for realtime monitoring. By forming wireless sensor network (WSN) we can make good monitoring systems in the Agricultural practices. The advantages of using Wireless sensor networks in agriculture are distributed data collection and monitoring, monitoring of climate, irrigation and nutrient supply. Hence decreasing the cost of production and increasing the efficiency of production. This paper proposes an idea about application of wireless sensor network for crop monitoring without man power. The paper discusses about how to utilize the sensors in agricultural practices and explains about Wireless Sensor Network (WSN), use of Zigbee technology in agricultural practices.

Keywords: agricultural practices, crop monitoring, data collection, gateway, wireless sensor network, zigbee technology.

I. INTRODUCTION

Agriculture is the backbone of the Indian economy. It employs around 600 million people and contribute around 30% of the Countries‟ GDP. The development of agriculture in terms of area of land under cultivation, use of modern equipment and financial assistance to the farmers is absolutely essential. One of the major problems present today is the less knowledge of the soil content & types, less knowledge of the type of fertilizers to be added, the irrigation amount and pattern of crop depending on the soil porosity and its water retention capacity. Without addressing these problems we cannot get fruits of green revolution‟. In countries like India large amounts of land being unsuitable for farming due to water lodging and subsequent salinity, improper and inadequate use of fertilizers etc. Thus there is a need for analyzing the type of soil and its constituents and also monitoring of the climate. In the current Indian scenario, analysis of soil to increase crop yields is not being used to a large extent primarily due to the cost involved and the inaccessibility of labs offering such testing facilities. But this is quite essential considering the grown oh India, a country whose backbone is agriculture. Moreover due to small size of land holdings the procedure of sending soil samples to a far off lab and then taking decision does not seem economically viable to the farmers.[1] Hence we should address a method which is capable of giving instantaneous result with less money and greater results.

The objective of the study is to link some agricultural parameters like soil, Water, crops, Irrigation, Chemical and fertilizers issues with a wireless sensor network, also study environmental issues of a specific region. Adopting a specific technique for controlling the agricultural parameters, like use of different sensors to sense the agricultural parameters, collect and transmit the information using Embedded System. Using wireless receiver receives the information and does the needful controlling action. Design the module which useful in rural development. Measure the performance and benefits to the farmers and also give a unique idea about how to establish a wireless sensor network for agricultural practice in countries like India.

II. WIRELESS SENSOR NETWORKS

A wireless sensor is a self-powered computing unit usually containing a processing unit, a transceiver and both analog and digital interfaces, to which a variety of sensing units are connected. These sensors automatically organize themselves into an adhoc network, which means they do not need any pre existing infrastructure; Zigbee is referred to such a network as an ad-hoc Wireless Sensor Network. Recently, WSNs [6] have raised considerable interest in the computing and communication systems‟ research community. They have decisive advantages, compared with the technologies previously used to monitor environments via the physical conditions such as temperature, humidity etc. can be adapted. Whenever physical conditions change rapidly over space and time, WSNs allow for real-time processing at a minimal cost. Their capacity to organize spontaneously in a network makes them easy to deploy, expand and maintain, as well as resilient to the failure of individual measurement points.

III. ZIGBEE

Zigbee is an industrial consortium designed to build a standard data link communication layer for ultra-low power wireless application. The Zigbee [4] data link layer is designed to operate on top of the IEEE 802.15.4 physical layer. The transmission bands operate at 868 MHz, 902-928 MHz and 2.4 GHz. Direct Sequence Spread Spectrum has a distinct advantage over channel hopping mechanisms because hop-sequence synchronization does not have to occur prior to initiating communication. This provides a large power advantage for low-duty cycle devices. [7] .The Zigbee standard will specify a communication mechanism that is comparable to the Amplitude Modulation communication layer provided in Tiny Operating Systems. Primitive data framing mechanisms, error detection, and addressing will be standardized to allow compatibility. Zigbee is primarily focused on star topology networks where low-wireless devices communicated to powered collection point. [1] A canonical Zigbee application is a wireless light switch. This would involve a low-cost battery operated switch communicating to a powered light fixture.

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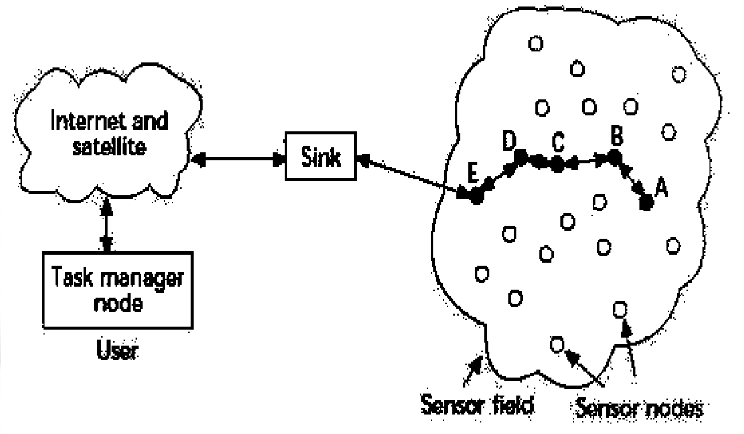

Fig. 1: gives an idea about the proposed WSN model.

IV. Data Collection

A canonical environmental data collection application [5]is one where a agricultural scientist wants to collect several sensor readings from a set of points in an environment over a period of time in order to detect trends and interdependencies. This scientist would want to collect data from hundreds of points spread throughout the area and then analyze the data offline. The scientist would be interested in collecting data over several months or years in order to look for long-term and seasonal trends. For the data to be meaningful it would have to be collected at regular intervals and the nodes would remain at known locations. At the network level, the environmental data collection application is characterized by having a large number of nodes continually sensing and transmitting data back to a set of base stations that store the data using traditional methods. These networks generally require very low data rates and extremely long lifetimes. Intypical usage scenario, the nodes will be evenly distributed over an outdoor environment. This distancebetween adjacent nodes will be minimal yet the distance across the entire network will be significant.[1]

After deployment, the nodes must first discover the topology of the network and estimate optimal routing strategies. The routing strategy can then be used to route data to a central collection points. In agricultural monitoring applications, it is not essential that the nodes develop the optimal routing strategies on their own. Instead, it may be possible to calculate theoptimal routing topology outside of the network and then communicate the necessary information to the nodes as required. This is possible because the physical topology of the network is relatively constant. While the time variant nature of RF communication may cause connectivity between two nodes to be intermittent, the overall topology of the network will be relatively stable. Agricultural data collection applications typically use tree-based routing topologies where each routing tree is rooted at high-capability nodes that sink data. [3] Data is periodically transmitted from child node to parent node up the tree-structure until it reaches the sink. With tree-based data collection each node is responsible for forwarding the data of all its descendants. Nodes with a large number of descendants transmit significantly more data than leaf nodes. These nodes can quickly become energy bottlenecks. Once the network is configured, each node periodically samples its sensors and transmits its data up the routing tree and back to the base station. For many scenarios, the interval between these transmissions can be on the order of minutes. Typical reporting periods are expected to be between 1 and 15 while it is possible for networks to have significantly higher reporting rates. The typical environment parameters being monitored, such as temperature, light intensity, and humidity, does not change quickly enough to require higher reportingrates. In addition to large sample intervals, agricultural monitoring applications do not have strict latency requirements. Data samples can be delayed inside the network for moderate periods of time without significantly affecting application performance. In general the data is collected for future analysis, not for real-time operation. In order to meet lifetime requirements, each communication event must be precisely scheduled. [1] The senor nodes will remain dormant a majority of the time; they will only wake to transmit or receive data. If the precise schedule is not met, the communication events will fail. As the network ages, it is expected that nodes will fail overtime. Periodically the network will have to reconfigure to handle node/link failure or to redistribute network load. [3]

Additionally, as the researchers learn more about the environment they study, they may want to go in and insert additional sensing points. In both cases, there configurations are relatively infrequent and will not represent a significant amount of the overall system energy usage. Hence that would not prove to be benificial at all. We need to develop a new technology that caters to these requirements so as to overcome these difficulties.

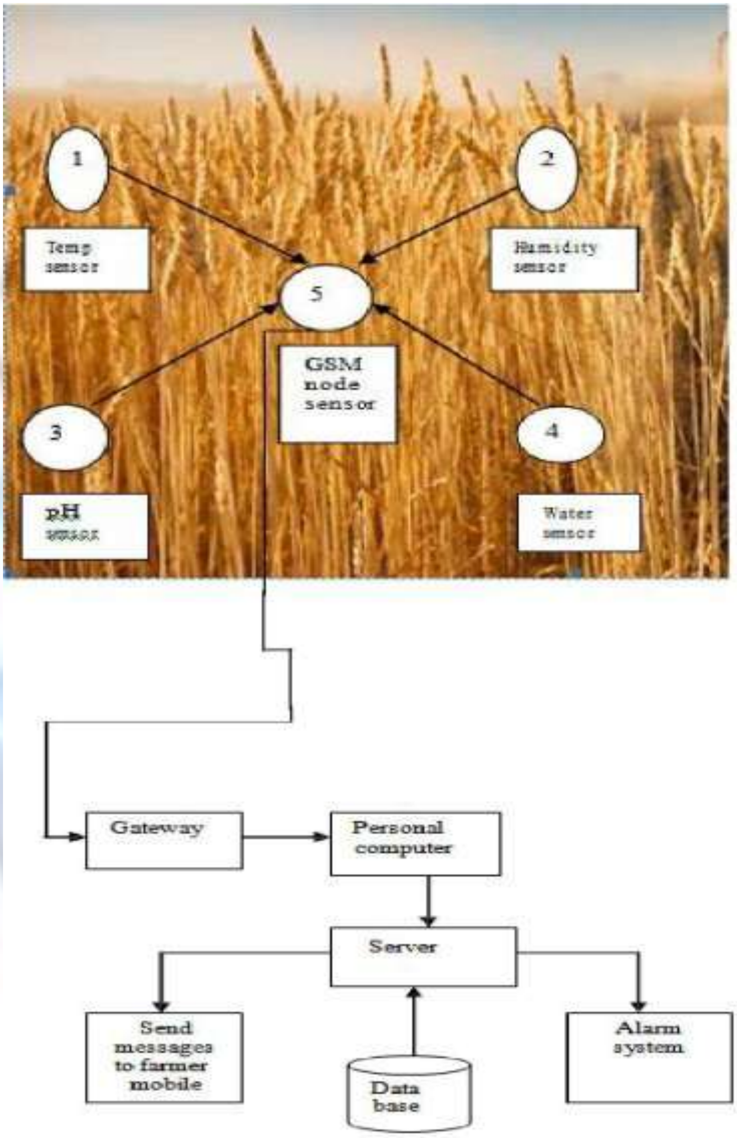

Fig. 2. The architecture of proposed WSN model

The most important characteristics of the agricultural monitoring requirements are long lifetime, precise synchronization, low data rates and relatively static topologies. Additionally it is not essential that the data be transmitted in real-time back to the central collection point. The data transmissions can be delayed inside the network as necessary in order to improve network efficiency.

V. THE PROPOSED WSN MODEL

The proposed wireless sensor network system [6] collects soil information content through digital sensors like DS18B20 which is the single line digital temperature sensor; it has many advantages such as miniaturization, low power consumption, high performance, and strong anti-interference ability and is easy to match microprocessor. WSN uses wireless transceiver module based on Zigbee [4] agreement to realize collection of soil information and transmits the information to a wireless chip to complete information collection and transmission. In the process of design, signal transmission frequency is around 400MHz. The design of the wireless sensor node uses the modularizing design method, the underground WSN uses another wireless chip, the structure of the entire nodes composed of sensor module, processor module, wireless communication module and energy supply module. [2] This design uses mixed wireless sensor network structure of the terrestrial and underground, traditional WSN is adopt in underground within depth20 cm. Sink node is only laid on the ground, all nodes in underground will transmit data eventually to the terrestrial sink node, which can make the whole network have better concealment. It can be displayed inthe same depth, also can be displayed in different depth and even can be set as different layer. [1] The sink node uses fixed or movable, which should be kept in the range of communication. The sensed data from various places of crop field area is transmitted to the central global system node or coordinator node, the information is sent to the personal computer through gateway.[2]

A server is connected to the database, which having crop field area**,** minimum and maximum threshold values of temperature, water level, Ph leveland other parameters. If the sensed data attends maximum or minimum threshold levels stored in the data base, the alarm unit will give alarm sound to the farmer and also we can make message deliver to the farmer. From that the farmer may get attention about the crop field. A Gateway is the device which can be used to connect two networks of different protocols. Some systems require a gateway or coordinator to establish time synchronization. From that gateway the data can be sending to the personal computer. From where the information will be send to farmers.

VI. CONCLUSION

In this paper, I have talked about hybrid wireless sensor network architecture for agriculture to reduce the intensive human involvement and to improve the accuracy of current agricultural information collection system. An advanced sensor network includes the terrestrial wireless sensor networks and wireless underground sensor networks, which improve the realtime and accuracy of information acquisition. In particular, this model provides collection functionality when the monitoring area is not in the line-of-sight region of the terrestrial sensor networks; and the mobile sink nodes provide information acquisition capability after they have been collected. The network architecture of the wireless sensor networks is first described. Finally, a test bed will be developed and field experiments will be conducted to test the performance of the wireless sensor networks system in the real agricultural applications.

ACKNOWLEDGMENT

The author acknowledges Professor Sukhwinder Singh for his valuable assistance and guidance in the preparation of this review paper.

REFERENCES

[1]. M.S.V.K.V. Prasad, A. Karna Rao, Prof. V. V. S. Naidu, Prof. G. Jagadeesh Kumar, Dr. G. J. Nagaraju, International Journal of Electronics & Communication Engineering Research (IJECER),Vol. 1 Issue 5, October- 2013www.ijecer.org
[2]. K. Nirmalkumar, P. Ranjith, R. Prabakaran, "RealTime Paddy Crop Field Monitoring Using Zigbee Network", International Conference on Emerging trends in Electrical and Computer Technology(ICETECT-2011), March,23,24, 2011.
[3]. Wang, N., Zhang, N., & Wang, M. "Wireless sensors in agriculture and food industry – Recent development and future perspective". Computer and Electronics in Agriculture, 50, 1-14.
[4]. ZigBee Alliance, The official website of the Zigbee Alliance: http://www.zigbee.org.
[5]. IEEE, IEEE 802.15 WPAN™ Task Group 4: http://ieee802.org/15/pub/TG4.html.
[6]. Cerpa A., et al., "Habitat monitoring: Application driver for wireless communications technology. ACM SIGCOMM", Workshop on Data Communications in Latin America and the Caribbean, 2001.
[7]. Mainwaring, A., et al., "Wireless Sensor Networks for Habitat Monitoring, in ACM", International Workshop on Wireless Sensor Networks and Applications (WSNA'02). 2002.