Precision Agriculture Prospects using Wireless Sensor Network

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Abstract

As population increases, it becomes necessary to improve the efficiency of farming practice. Advancement in wireless sensor network made this idea possible which was nearly impossible few decades ago. Real-time data can be collected using Wireless sensor network which can be useful for taking various types of decision for farming practice. so that large amount of output can be gained using limited amount of resources and there is no waste of resources. Study some of the agricultural parameters such as soil, Water, crops, Irrigation, Chemical fertilizers issues and environmental issues of specific region. Adopt technique for controlling the agricultural parameters that Use different sensors to sense the agricultural parameters, Collect transmit the information, wireless receiver receives the information. Design the module which useful in rural development and observation of readings. Always measure the performance and benefits to the farmers. WSN is an intelligent private network made by a large number of sensor nodes which do specific function. Precision agriculture and WSN applications combine an exciting new area of research that will greatly improve quality in agricultural production, precision irrigation. There are potential applications of wireless sensor network technology in agricultural systems such as real time field monitoring, automated irrigation control, monitoring, and remote operation of field machinery. The information centre stores and processes the data.

Keywords

Precision Agriculture, Wireless Sensor Network.

1. Introduction

This network has capability of data acquisition and data processing on environment. During the processing, it used internal communication and external communication of node. The information collection by node to node in the network. The sensor can detect the event of monitored like temperature, light, and pressure. The node reported to the base station and take action on it. The network that can physically imprison the node and get the information contained in the sensor network.

Sensor networks are used to collect distributed information from a given location. It includes tiny devices with a power, a microprocessor, a wireless interface, some memory, and more than one sensor. The sensors collect physical parameters like light intensity, temperature. The sensor nodes communicate by wireless multi-hop map-reading via intermediate nodes.

Wireless sensor networks that huge number of tiny sensor nodes with memory space, limited computation capacity. WSNs include sending messages to nodes at a given location and retrieving sensor data from nodes in a give region. These are model to monitor the environment in various applications like military surveillance, agriculture and health care, Scientific Exploration In wireless sensor networks; it is   possible that DOS attack can report false data. Today available number of filtering schemes against false reports.

 The Aggregate performance is important and location is essential. Many wireless sensor networks utilize minimal capacity devices. Wireless sensor network designs have evolved from primarily focusing on data collection like data-centric storage. The communication protocols also evolved from basic many to one and one-to-many communications. The famous point-to-point wireless protocols such as AODV and DSR do not meet the constraints of wireless sensor networks. The functionality of wireless sensor networks is to detect and report actions.

The node is preloaded with symmetric keys. When an event occurs multiple neighboring sensors together generated report that carries multiple message authentication codes (MACs).A MAC is generated by a node using one of its symmetric keys. As a report is forwarded towards the sink over multiple hops that each forwarding node verifies the

correctness of the MACs and carried in the report probabilistically.

Wireless Sensor Network (WSN) allow faster deployment and installation of various types of sensors as the network provides self-organizing, self-configuring and self diagnosing capabilities to the sensor nodes. It is a system comprised of radio frequency transceivers, sensors, microcontrollers and power source [2].
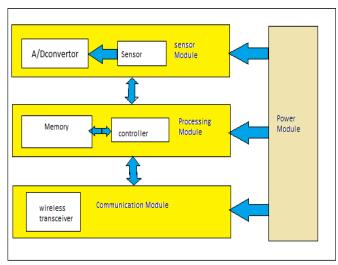

Figure 1.WSN Node Architecture [10]

2. Application of WSN

- Environmental Application
- Commercial Application
- Area Monitoring
- Health application
- Military application
- Scientific Exploration

3. Major challenges of the WSN

Wireless Ad-hoc Nature

Wireless standard has many challenges in wireless sensor network. The packet is vanished in the environment. Mobile Ad-hoc network is one of the types of wireless sensor network. It is possible to many difficulties.

Energy Constraints

Wireless sensor networks energy constraints is largest issues. Sensor nodes with a small size, small battery, tiny central processor unit and small memory. The sensor nodes are stationary that communication protocols between sensor nodes. One of effective approaches that decrease redundant

data sent by sensor nodes to the base station is data Aggregation. The process of simulation results illustrated that balanced topologies give a hand to minimize data collision and to make longer network lifetime. It is demanding to draw out energy-power and network generation of wireless sensor networks.

Mobility and Topology Changes

A single node has neighboring nodes which direct communication would be probable when using adequately big transmission power. however, unavoidably beneficial for high transmission power requires lots of energy power, The neighbor node has burden for a MAC protocol and routing protocols go through insecurity in the network when nodes

Data Aggregation

To Design large wireless sensor network important challenges is energy efficiency. Energy maintenance must be careful as a most basic constrain of network lifetime. Data Aggregation is technique that collecting and aggregating the data. Data collecting is defined as the organized gathering of sensed data from multiple sensors that transmitted to the base station. The sensors transmit the data directly to the base station. The request will be send from the base station to the sink to evaluate and discover the suitable result.

Security Issues

The wireless sensor network has fundamental technology in future due to its much Application. These networks are easily disposed to security attacks. The battery and low memory are limitation of sensor networks to use conventional security solutions.

Why Wireless Sensor Network?

Wireless sensor network is significant technology for large monitoring area. The Sensor has facility to determine at high temporal and spatial resolution. The determined data are dispatch to a base station. The technology has range to many application Agriculture, forest, waterway and building. The wireless sensor has few devices single-chip radio transceivers, microcontrollers and battery. The component produces the information. The WSN one small fraction of a system that includes internet relations from the WSN to a server.

4. Motivation

Heath Monitoring

The medical sector is continuously used the sensor for advancement in healthcare. The different equipment to sense and monitor the temperature, pressures, chemical, biological levels of patients. The medical segment provided rapid penetration of image sensors in image sensing equipments, several temperature sensing devices.

Flight Tracking

This tracking system helps to identify the flight and its location. System that collect both flight track and identify aircraft from radar sensor. It is beneficial to first time user who visits the airport.

Home security

Home security alarm by using the wireless sensor network. It can detect the theft, fire and leaking of gas. It sends the alarm message remotely. The short message sends to mobile phone in dangerous condition to secure the home.

Agriculture

The Agriculture sector is of the important source of income. The Important component related to agriculture is the water, temperature and soil. The used of environmental parameter and resources monitor the system. The Agriculture used the new technology to reduce the cost of crop production. The technology obtained data mining, Wireless sensor network, Zigbee , GSM and GPS for agriculture. The technique is monitor and controls the temperature, irrigation and humidity from the remote location. The different methodology or algorithm like MATLAB, KEEL software tool Gaussian Naive Bayes DM algorithm, Arduino platform, LABVIEW to control the green house.

5. Precision Agriculture

Precision Agriculture (PA) perform important role in the modern agriculture. Precision agriculture can help us manage the crop production input in an environment. It requires different method to gather the information, also reduce the need for expensive and sampling. The aim of precision agriculture is to profitability, control, engineering innovations in sensors, remote sensing and information management of environment.Precision agriculture is processing to keep high productivity, low cost and less environment pollution.

The WSN system for PA requires a centralized control unit with user interface, communication gateways and routers, power elements and most importantly are the sensors [10]. Architecture of WSN in PA environment with several nodes is shown in fig.
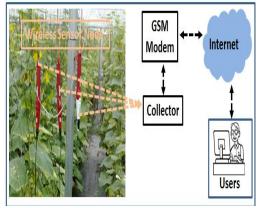

Figure 2. Architecture of WSN in PA

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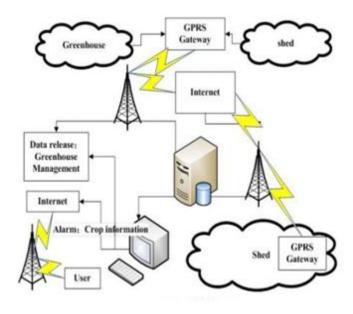## 6. Environment Monitoring System for Precision Agriculture

Figure 3.System Infrastructure [9]

7. Functionality of component

Gateway node: collects data from sensor nodes and Forwards it to remote server using GPRS Module [9].

Server: it gets data from the gateway node and processes it using collection module the sub system are below Collection module, Web-based component and Alarm Subsystem.

Data Acquisition subsystem: it consists of number of TelosB wireless sensor nodes to acquire data. The board sensors temperature and humidity sensors.

8. Previous Work

The agriculture sector production is worldwide. It's contain the activity like soil conservation, water availability, pest and dieses. The environment parameter and resources make effective to precision agriculture to monitor the system. Decision support system that monitoring crops. It use the new technologies such as wireless sensor networks[1]. The tools provide real information about pest, diseases and crop status. The evaluation of a predictive model for pests and diseases is technology acceptance model (TAM) .The KEEL software tool use Evolutionary Algorithm for better crop management.Using the module reduce the cost and improve the crop production. The crop-weather-pest/disease relations interdependent pest (Thrips), disease.

The unmanned aircraft systems (UAS)[3] is important application of remote-sensing for precision agriculture. Cereal rye was planted for a winter cover crop with fall and spring fertilizer applications. That produced differences in biomass and leaf chlorophyll content. For detecting true color used UV-IR cut filter. The external red cut filter was used to obtain color-infrared.the requirement is obtained by small pixel sizes. It may not essential to large numbers of photographs with very small pixel sizes.

The Greenhouse management based agriculture [4] is a combination of included information and production that based farming system. Wireless sensor network used to monitor and control the parameter inside the green house. The System used the CPU for monitoring data in with LABVIEW and Zigbee with PIC microcontroller between two distant locations. The Zigbee technology control and monitor temperature, humidity and irrigation in the green house.

The precision Agriculture based on wireless sensor network that monitor environment in green house located at hill side[9]. The system collects the illumination, temperature, humidity and other parameter of the zone. The system automatically transmits the data to the remote server via GPRS in real time. The system include web-based platform integrated with Google Maps to green house environment status. The monitor the temperature, moisture and humidity. The Wireless sensor network technology enables automatic irrigations in green house. Precision agriculture optimises the use of water fertilizer and crop.

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This Wireless Underground Sensor will provide autonomous irrigation management capabilities The monitoring the soil conditions in real time using wireless sensors. The result high light wireless communication .The result highlight wireless communication channel between soil and air. It also requires the location and depth of the sensors, soil texture, soil moisture, and the vegetation canopy height. It may first work in development of an autonomous precision irrigation system with WUSNs. [11]

9. Conclusion

The farming practice is based on assumptions only. Resources are provided by predetermined data. Requirement cycle of Different crops using data and analysis of working on them. Collecting real -time data on weather, soil and air quality, Smarter decisions can be made. The automatic control Mechanism is implemented to complete the required Environment control and adjustment .It improve efficiency Of crop and increase the production plan.

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