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Enlarging the Agricultural Structure by using Wireless Sensors Networks

P.Boopathi,M.Kavitha,Dr.T.Kalai Kumaran,Dr.S.Karthik

Abstract **– Sensors are playing main roles in human life like as remote monitoring of environment, habitat, agriculture, health care, automobiles, hazardous zones, disaster prone zones, defense applications to probing of planets. Above all they can be used for monitoring as well as control. Really, they form the basic constituent of ubiquitous sensing, communication, computing, and control. The WSN applications in agriculture fields to sensing the yield optimization and minimization of the cost incurred in farming. The sensor nodes may be deployed on the field to measure various atmospheric and soil parameters. These can help in making decision on irrigation, fertilizer and pesticide applications. In this paper, we have discussed that study on how to develop farming system by using Wireless Sensors Networks (WSN).**

Index Terms **- sensors, farming system, Precision agriculture.**

I.INTRODUCTION

Wireless sensor networks have shown promise to address various issues faced by rural community. With the help of WSNs, many of the farming activities can be precisely done resulting in yield optimization and minimization of the cost incurred in farming.

P.Boopathi *- Assistant Professor, Dept of CSE, SNS College of Technology- Coimbatore, India*

M.Kavitha *- Assistant Professor, Dept of CSE, SNS College of Technology- Coimbatore, India*

Dr.T.Kalai Kumaran *- Professor and Head, Dept of CSE, SNS College of Technology- Coimbatore India.*

Dr.S.Karthik *- Professor and Dean, Dept of CSE, SNS College of Technology- Coimbatore India.*

The WSNs may also serve for the applications such as intruder detection, pest detection, plant disease prediction, fire detection, automating irrigation. It includes the monitoring environment as Temperature, Humidity, Soil Moisture, Wind speed, direction, Rain Fall, Sunshine, and Carbon-di-oxide (CO2).Sensor Networks are ideal for monitoring environmental conditions like effecting plant growth in areas that are not as easily controllable as those of a greenhouse. Studying the effects of microclimates on plants will allow scientists to better understand the ways in which to optimize yield and quality [1][5]. Each node measures light levels, air temperature and humidity, with optional measurements of soil temperature and soil moisture. In addition, battery levels for each node can be monitored for diagnostic purposes.

II.APPLICATION AREAS OF WSN

Sensor Networks are emerging as a great aid in improving agricultural productivity, quality and resource optimization .Sensor networks often are expected to operate in an unattended fashion in dispersed and/or remote geographic locations: Nodes may be deployed in harsh, hostile, or widely scattered environments. Such environments give rise to challenging management mechanisms. At the other end of the spectrum, sensor nodes are occasionally deployed densely either in close proximity with or directly inside the environment to be observed [3]. WSNs are collections of compact-size, relatively inexpensive computational nodes that measure local environmental conditions or other parameters and forward such information to a central point for appropriate processing.

WSNs nodes (WSNs) can sense the environment, can communicate with neighboring nodes, and can, in many cases, perform basic computations on the data being collected. WSNs supports a wide range of useful applications are,

- Tracking wild fires
- Tsunami alerting

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- Supporting the straightforward installation of wireless sensors to monitor a wide variety of conditions
- Smoke, CO, and H2O detectors
- Sensor networks to detect and monitor environmental changes in plains, forests, and oceans
- Radar used to profile soil composition in vineyards
- Monitoring wild fires
- Farm sensor and actuator networks (monitoring soil moisture, feeding pigs, unmanned tractor control)
- Flexible management of lighting, heating, and cooling systems from anywhere in the home
- Food safety
- Environmental control (e.g., tracking soil contamination, habitat monitoring)
- Environmental monitoring, including precision agriculture
- Environmental sensing applications
- Environmental (land, air, sea) and agricultural wireless sensors

III. KNOWLEDGE AREAS OF WSN

Several applications have been benefited from the advances in wireless sensor networks. These include Agriculture, Health Care, Defense, Wild Life Habitat Monitoring, Under Water monitoring, Disaster Management (Safety) and Industrial (monitoring, control, factory automation) applications. For all these applications, research deployments have been conducted and products incorporating WSNs are appearing. The current research hence focuses on application-driven systems in order to address more concrete issues. Preliminary results obtained from these deployments are encouraging and widespread use is highly likely [2][7].

- Military and Security
- Tele-health and Medical Monitoring.
- Rural health monitoring
- Agriculture: Monitoring farms, soil moisture, and environmental factors that impact plant growth and disease propagation.
- Cold chain: Managing the temperature of food products as they traverse roads, sea and storage.
- Medicine storage parameters tracking.
- Watershed monitoring and Water supply management.
- Ecological and Environmental Scientific investigation
- Pollution monitoring in urban and industrial area.
- Protecting historical artifacts.
- Sea-port water depth and traffic monitoring for efficient management.
- Threat-Identification or Event Detection.
- Structural health monitoring
- Automation
- Medical Monitoring
- High Value Asset Tracking
- Consumer Devices
- Urban (shopping malls, metro train stations, bus stops) and residential security.
- Coal mine monitoring for poisonous gases

IV. WSNs in AGRICULTURE FIELD

Traditionally, a large farm is taken as homogeneous field in terms of resource distribution and its response to climate change, weeds, and pests. Accordingly, farmers administer fertilizers, pesticides, herbicides, and water resources in reality, wide spatial diversity in soil types, nutrient content, and other important factors [9]. Therefore, treating it as a uniform field can cause inefficient use of resources loss of productivity.Since Precision agriculture is a method of farm management that enables farmers to produce more efficiently through a frugal use of resources.

A. Monitoring Agricultural Conditions

The monitoring environmental and soil conditions can make farming more profitable and sustainable, for instance, through better water management and pest and disease control (It is estimated that the overall efficiency of water use for agriculture is less than 25 per cent). Improved operation and management of Water for irrigation can lead to significant savings and to a more sustainable use of water resources, as well as enhanced soil productivity. The some following tools can be used in agricultural and soil monitoring to enhance the farming system and increase the production, which

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includes: Stand-Alone Sensors: These sensors measure air temperature, atmospheric pressure and humidity [5].

There are two units in this fields are, Ubiquitous Sensor Networks (USN): In this network the sensor nodes are deployed on the field and transmitting data to a base station. This data can also be uploaded to global systems and can use or analyzed for different purpose and this makes the farming conditions much better. Telemetry Units: These units are used to transmit air temperature, humidity, leaf wetness data, solar radiation, wind speed, and soil moisture, using cellular networks.

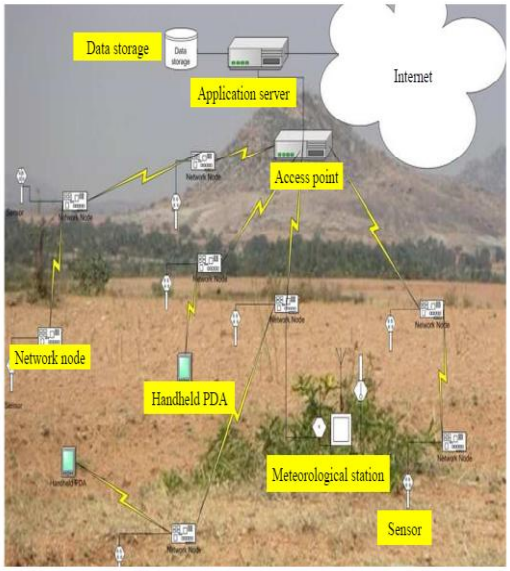

Fig. 1 Monitoring and Analysis of Agriculture Field

B. Precision agriculture

In this environment, the sensors network is used to monitor environmental parameters of crop cultivation, so that the farmer knows, for example, when having water or when to use certain pesticides. Thanks to combination of sensors such as humidity, temperature, and light and so on. Avoid the risk of frost, as well as any plant diseases or you can control the level of irrigation based on soil moisture and leaf wetness , precision agriculture technologies having yield monitors, yield mapping, variable rate fertilizer, weed mapping, variable spraying, topography and boundaries ,salinity mapping and guidance systems. The precision agriculture has the 'aim of optimizing the production and taking into account local soil and climatic variations. In the field of plant/crop monitoring, wireless sensors have been developed to gather, for example, data on leaf temperature, chlorophyll content and plant water status. Based on these data, farmers are able to detect problems at an early stage and implement real-time solutions. The health and moisture of soil is a basic prerequisite for efficient plant and crop cultivation [6]. Sensors contribute to real-time monitoring of variables such as soil fertility, soil water availability and soil compaction. Further, sensor nodes which communicate with radio or mobile network weather stations provide climate and micro-climate data. Sensors registering the temperature and relative humidity can contribute to detect conditions under which disease infestation is likely to occur in Fig 2.

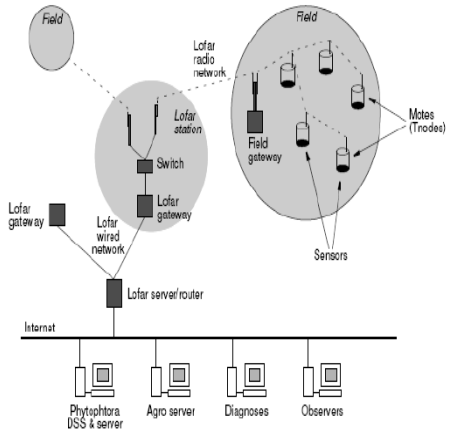

Fig. 2 Environment for Precision agriculture

Sensor nodes send the gathered data via a wireless connection every 10 minutes to field gateways which send it to an ordinary PC for data logging [2]. The data is further transmitted to other servers for data analysis via a wired Internet connection. A decision support system maps the temperature distribution together with other information. Based on this information, farmers can take different actions and vary the amount of fertilizer and pesticide used. Wireless sensors are further used for precision irrigation, and systems developed for remotely controlled, automatic irrigation. Sensors assume, for example, the tasks of irrigation control and irrigation scheduling using sensed data together with additional information, e.g. weather data. Sensors are used to assist in precision fertilization. Based on sensor data, decision support systems calculate the "optimal quantity and spread pattern for a fertilizer". Further important benefits of precision agriculture are reductions of fertilizers

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and pesticides [4][8]. Both fertilizer and pesticide applications affect surface and groundwater quality, the quality of crops, soil properties and non-target species. Through monitoring the soil, the micro-climate and crops, it is possible to apply only the fertilizers and the pesticides crops need. Rates can be varied in real-time within fields based on different field and plant properties. Additionally, applications can be more precisely controlled in environmentally sensitive areas. Finally, a more targeted application of pesticides can reduce problems of pesticides resistances.

V. CONCLUSION

In general, sensors and sensor networks significantly contribute to a more sustainable use of natural resources. However, development of sensors and sensor networks for precision agriculture is in an early stage and sensor applications tend to be expensive. As on date, farmers only take economic benefits into consideration when deciding on whether they should rely on precision agriculture. Farmers to recognize the environmental dimension by pointing out the economic benefits of improved soil and pasture quality as well as reduced applications of fertilizers and pesticides. Finally this study will helps to understand briefly on Farming methods in WSN and Applications and its Research issues.

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P.BOOPATHI received B.E Degree in Computer Science and Engineering from the Anna University, Chennai, in 2008 and Master's Degree in Computer Science and Engineering in Anna University of Technology, Coimbatore, in 2010. At present, She is an Assistant Professor of Computer Science and Engineering in SNS College of Technology, Coimbatore. Her research interest focuses on MANET and Data Structures.

M.KAVITHA, At present, she is an Assistant Professor of Computer Science and Engineering in SNS College of Technology, Coimbatore. Her research interest focuses on MANET and Theoretical Foundation of Computer science.

Dr.T.KALAIKUMARANN received the MCA. degree in computer science and engineering from the Madras University, Chennai, India in 1994, M.E.degree in computer science and engineering from College of Engineering, Anna University, and Chennai, India in 1999. PhD in computer science and

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engineering from College of Engineering, Anna University, and Chennai, India in 2013.Currently, he is a professor and Head at the Department of Computer Science and Engineering, SNS College of Technology, Coimbatore, India. His research interests include temporal database management systems and object oriented systems.

Dr.S.KARTHIK is presently professor & Dean in the department of computer science and engineering, SNS College of Technology, affiliated to Anna University- Coimbatore, Tamilnadu, India. He received the M.E. degree from Anna University-Chennai and Ph.D. degree from Anna University of Technology, Coimbatore. His research interests include Network security, web services and wireless systems. In particular, he is currently working in a research group developing new Internet Security architectures and active defense systems against DDoS attacks. Dr.S.Karthik published more than 35 papers in refereed international journals and 25 papers in Conferences and has been involved many international conferences as Technical chair and tutorial presenter. He is an active member of IEEE, ISTE, IAENG, IACSIT and Indian Computer Society.

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