# Proposed System for Design and Implementation of Smart Agriculture System using Wireless Sensor Networks

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*Abstract*— The main aim of this paper is to design and implement smart agriculture system for monitoring information concerning an outdoors agricultural production environment utilizing Wireless Sensor Network (WSN) technology. The main objective of this paper is to monitor and store the necessary details such as temperature, pressure, humidity, soil and other parameters that influence cropland growing environments. Real-time sensor data collection is used for accurate illustrations of current conditions while forecasting future conditions and risks. The real time information from the fields can provide a solid base for farmers to adjust strategies at any time. Instead of making decisions based on some hypothetical average condition, which may not exist anywhere in the reality. This agricultural environment monitoring server system could even monitor the environmental information on the outdoors remotely. It could be expected that the use of such a system could contribute to increasing crop yields and improving quality in the agricultural field by supporting the decision making of crop producers through analysis of the collected information. WSN can operate in a wide range of environments and provide advantages in cost, size, power, flexibility and distributed intelligence, compared to wired ones.

***Key words:*** Wireless Sensor Network, Agriculture System, Sensors

## I. INTRODUCTION

India being an agricultural country needs some innovation in the field of agriculture. This can be achieved through modern technologies which assist computing, communication and control within devices. WSN technologies have become a backbone for modern precision agriculture monitoring. WSN in agriculture helps in distributed data collection, monitoring in harsh environments, precise irrigation and fertilizer supply to produce profuse crop production while diminishing cost and assisting farmers in real time data gathering presents the preliminary design on the development of WSN for crop monitoring application The proposed WSN system will be able to communicate each other with lower power consumption in order to deliver their real data collected to the farmer's. Agricultural crop yields depend on environmental conditions, and the response of plant growth to changing environmental conditions is extremely complicated.

Recent advances in Wireless Sensor Technologies have led to the development of low cost, low power, compact sensor nodes. This provides enormous opportunities in research and development of numerous applications. Wireless Sensor Networks (WSN) are seen as one of the most promising contemporary technologies for bridging the physical and virtual worlds thus, enabling them to interact. WSNs are used in both military and civilian applications including wireless data acquisition, smart buildings, target tracking, habitant monitoring, environmental contaminant detections and precision agriculture.

Deployment of WSN for Smart Agriculture Environmental provides a decision support system tool for growers to: -

- Identify the amount of nutrients deficiency within the targeted crop fields.
- Conserve water through data monitoring soil moisture levels to determine when and where there is lack of water in the root system, despite the moist appearance of the ground surface.
- Reduce potential profit loss by providing timely and accurate data that could be used for predicting undesirable climate changes and triggering quick action to protect fragile crops.
- Increase productivity and minimize labor costs by performing timely thinning, pruning, spraying, and harvesting.

## II. LITERATURE REVIEW WIRELESS SENSOR NETWORKS

A wireless sensor network is a collection of nodes organized into a cooperative network [6]. Each node consists of processing capability (one or more microcontrollers, CPUs or DSP chips), may contain multiple types of memory (program, data and flash memories), have a RF transceiver (usually with a single omni-directional antenna), have a power source (e.g., batteries and solar cells), and accommodate various sensors and actuators. The nodes communicate wirelessly and often self-organize after being deployed in an ad hoc fashion. Systems of 1000s or even 10,000 nodes are anticipated. Such systems can revolutionize the way we live and work.[5].

WSN are spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location[7].

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting[8]. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple

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star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding[9].

### *A. Wireless Sensor Network for Agriculture:*

Simulation models of crops, pests, diseases and farming operations are important tools for required information. It helps in calculating the water needs of the crops during growing period. The environment monitoring data provided over time and space by sensors can be used to validate and calibrate existing models[1]. Farmers can monitor in real time the field conditions. This all can help them to take better decisions on crops, moisture conditions, climatic changes, water conditions, etc. Nowadays, irrigation, fertilization and pesticides management are often left to the farmer and agronomist's discretion: common criteria used to guarantee safe culture and plant growth is often giving a greater amount of chemicals and water than necessary [3].

The most suitable technology to fit an invasive method of monitoring the environment is a Wireless Sensor Network (WSN) system [2]. Starting from 1994, Blackmore et al. [10] defined it asa comprehensive system designed to optimize agricultural production by carefully tailoring soil and crop management to correspond to the unique condition found in each field while maintaining environmental quality. The technologies proposed at that point comprised of three aspects: Remote Sensing (RS), Global positioning System (GPS) and Geographical Information System (GIS)[10].

## III. METHODOLOGY AND IMPLEMENTATION

1) Theoretical study of existing wireless nodes in agriculture system based on the study.
2) Design of Wireless Sensor nodes as direct sowing, seed plantation, nutrient management and water management.

A sensor node is also typically known as a 'mote' a term which is chiefly used in North America. A sensor node in a wireless sensor network is capable of gathering sensory information, processing and communicating with other connected nodes in the network. It consist of a Micro Controller for processing of the data with Sensor and Transceiver.

The typical architecture of the sensor node is as shown in fig 1

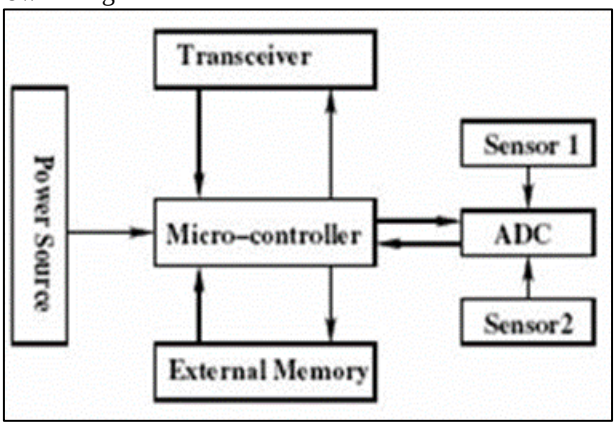


Fig. 1: Sensor Node Architecture

The proposed system can be implanted as shown in below fig 2.

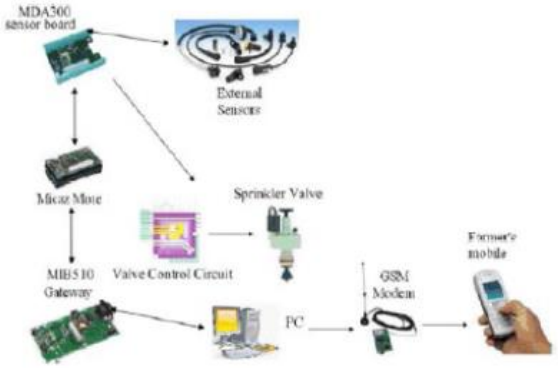


Fig. 2: Overall Architecture of design

The system, shown in Fig. 2, comprises an overall self-organizing mesh WSN with sensing capabilities, a Gateway, which gathers data and provides information to the final user capable of monitoring and interacting with the instrumented environment. The crop management system using Wireless Sensor Network (WSN) is a kind of an autonomous solution to enhance the agricultural technology. Precision agriculture could raise the crops yield, labour cost saving and environmental protection against over pesticide or fertilizing. Therefore in this project we would like to propose a wireless sensor system that will communicate each other with lower power consumption. This is served with the help of Micaz motes from crossbow technologies. The architecture then to be implemented in the sensor nodes will construct a wireless networking data collection at crop field likely to replace the conventional manually data collection system. A general mote with data acquisition board has standard measurement parameters sensors such as ambient air temperature and humidity and also has external terminals for soil pH, soil moisture, leaf wetness and atmospheric pressure sensors all to be integrated in all nodes. All the deployed nodes will collect the parameters and report to the central co-ordinator /sink as shown in fig 3

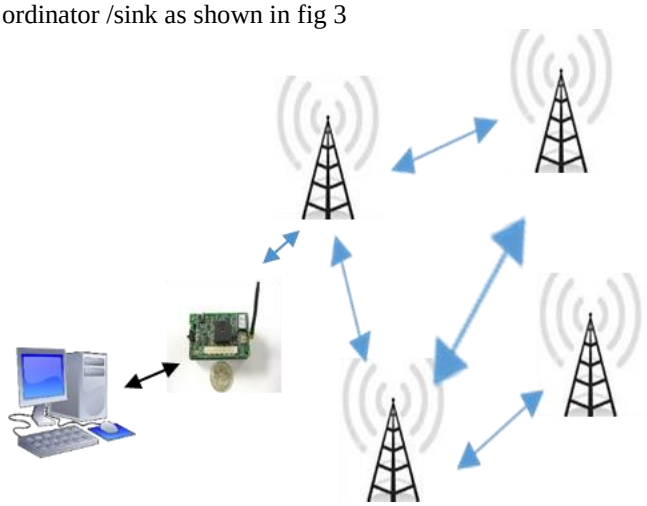

Fig. 3: Xmesh smart Proposed Agriculture system

## IV. POSSIBLE OUTCOME

– Automated Agriculture & Wireless Sensor Network application combine an exciting new area of research network will help to solve a lot of agriculture problems and to improve the crop growing.

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- WSN can be used to test the land assess its suitability for crop and ensure that it is free from diseases and harmful fungi for old used lands and reclamation of new lands model the crop to be used as decision control tool for farmers.
- System proposed includes sensing physical parameters and hardware node deployment number determination and most suitable routing strategy.
- Last, most important crop are selected to study the usage of WSN for automated farming in INDIA.

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