

# Remote Agri-Plant Monitoring System using Wireless Sensor Networks

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**Abstract**— Agriculture is one of the fields which require the involvement of man power to perform the regular activities such as pumping of water, sprinkling fertilizers etc., to maintain the crops gets grown without any deficiency. But the source of human power is gradually decreasing due to the westernization of the globe .In future there may be the case of no farmers are available to cultivate the crops. With an eye of all these impacts, this paper is focusing on the automation of supplying water, fertilizers etc at the exact level required for each and every crop instead of concentrating on full area equally without any human intervention. The main aim behind this idea is the person who doesn't know about the agriculture should also be able to perform the cultivation, so that dependencies on other countries for the basic food items will be avoided.

**Keywords**—Agriculture, plant monitoring system automated activities

## I. INTRODUCTION

Agriculture is one the areas which requires more man power with less labor cost. This is the field where natural resources are to be utilized efficiently. An emerging technology helps to achieve a better management of crops in the agricultural field by periodic management of crops in all the phases. This technology leads to higher yields and lower costs in the running of large scale commercial agricultural fields. These are helpful for quicker response times to adverse climatic conditions, better quality control of the produce and yet a lower labor cost. The highly automated agriculture requires intensive sensing of climatic conditions at the ground level and rapid communication of the raw data to a central repository. At the central server, with the availability of computational power, decision making and control of farm equipment is done. Modern agricultural management practices are changing from assuming homogenous fields to attempting to address field variability by dividing the field into smaller zones separately. Automated system is defined as the gathering of information dealing with spatial and temporal variation within a field and then using that information to manage inputs and practices.

The plant monitoring system has the following modules:

- Sensing agricultural parameters
- Measuring the water level consumptions for each crops and distributing water based on the humidity level.
- Measuring the fertilizer level needed for each crop.
- Gathering data of crops for analytics

Agricultural Sensors, positioning systems for detecting location of sensors, actuators like sprinklers, foggers, valve-controlled irrigation system, etc. are already available in market. However, very limited work has been done so far on the technologies to be used to transfer wireless sensor data from crop field to the remote server. All the information like the following will be stored in the data centers for later comparison.

- Application rate and time for fertilizers, lime, and pesticides
- Planting dates
- Village practices, and
- Cultivar selection.

Each of these decisions has generally been controlled at the field level, even though it has been known for many years that within-field variation in soil characteristics, topography, drainage, etc., results in yields below field capacity.

## II. LITERATURE SURVEY

[1] discussed only about the alert messages which are transferred to the central data center via the communication device called SMS. The data collected at the central location is used only for analytics. [2] discussed how the sensors placed at different locations of the field will perform the actions, how all the data will be aggregated and perform the automated task for managing the plants. But it fails to represent the actual data. Since it uses RFID, all the data collected are not fully reliable. It also describes about the routing algorithms which is used to communicate within the deployed sensors. [3] discussed about the aggregation of data in the data center just for monitoring and not automated. The proposed system in [4]

concentrates primarily on the sugarcane plant and not suitable for the other plants. All the real time data will be collected from the field and transferred to the zigbee based base station and threshold is set upon based on some limits. If the data values exceed the threshold limit, information will be passed to the decision center. Based on the expert reviews, later the action will be taken accordingly. The proposed system in [5] deploys ARM7 based 16/32 bit microcontroller which measures humidity, temperature and content of soil moisture which is displayed in LCD and saved in the database for further analysis. [7] describes briefly about all the technologies available for the precision farming.

### III. TECHNOLOGIES

There are varieties of technologies available for the plant monitoring. Some of them are Bluetooth, Global positioning system(GPS), Variable Rate Technology, Yield Monitoring and Yield Mapping, WI-FI, Sensors. Here we focused mainly on the variety of sensors.

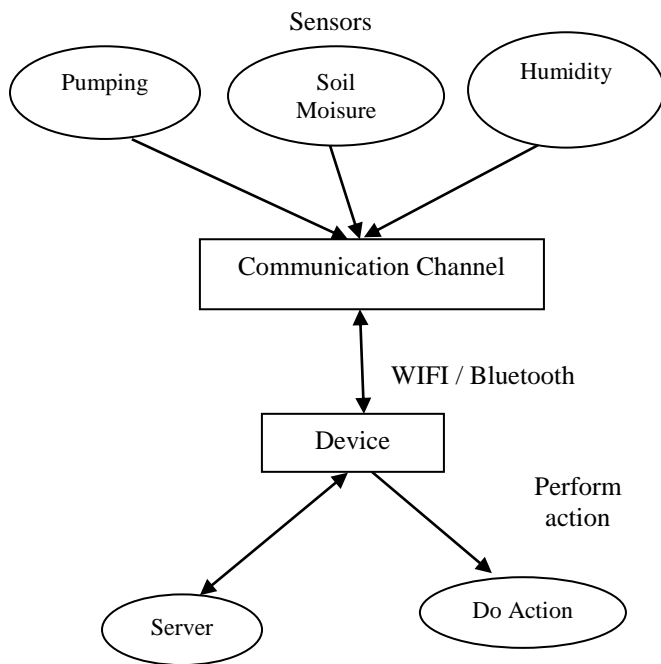


Fig 3.1 Process Flow Diagram

#### A. Bluetooth

A Bluetooth is a chip based peripheral which is used to exchange data through wireless over short distances. Bluetooth is a low power radio technology for communication. Bluetooth was developed to replace cables and infra-red links within a ten-meter diameter. It can be connected with any mobile, desktop, PDA, printers etc. Bluetooth can be used for the communication due to its low cost and the battery life.

#### B. Global Positioning System (GPS)

The GPS is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The GPS is not used in this project because of the major cost will be wasted in implementing the satellites.

#### C. Variable rate Technology

The Variable Rate Technology (VRT) describes any technology which enables producers to vary the rate of crop inputs. VRT is not used initially in this project as this is used for only comparison after the crop reaches its yield state.

#### D. Yield Monitoring and Yield Mapping

Yield Monitoring is the most direct method to assess the field production and how it should be better managed. A yield monitor measures the crop as it is harvested. YMs usually measure crop weight, impact forces, or the time an array of light beams are broken. Again yield monitoring can be used in this project at the final stage after the cultivation of the crop.

#### E. WI-FI

WI-FI is a wireless local area networks that aggregates various electronic devices such as desktop, mobiles, PDAs, digital cameras etc., to form a wireless network which uses 2.4 GHZ UHF and 5 GHZ ISM radio bands. With the help of WI-FI one smart phone is used to connect with the Internet and the network of maximum 8 nodes, referred to as hotspots. By using hotspots, the cost can be cut in accessing the network. But the security is quite less when compared with the Ethernet (wired connection). WIFI can be used in this project for communication between the deployed sensors in the farm.

#### F. Sensors

Sensors are transducers which are used to detect according to the characteristics it is classified on. The sensors like humidity sensors, soil moisture sensors, pressure sensors can be used in agriculture sector to determine crop stress, soil properties, pest etc.

##### a) On-the-go Sensors:

Measurement of plant and soil properties as the tractor travels over the field is a developing area in the automatic management of plants. Whenever the tractor starts plough the field, it starts to gather all the data related to the management of plants. All the data collected will be transferred to the central data collection center to analyze the collected data from the field. These on-the-go sensors are primarily used to collect the humidity level of the field, soil properties etc..

##### b) Remote Sensors:

Remote sensors are generally categorized as aerial or satellite sensors that can provide instant maps of field characteristics. An aerial photograph is optical sensors that can show variations in field color that correspond to changes in soil type, crop development, field

boundaries, roads, water, etc. Both aerial and satellite imagery can be processed to provide vegetative indices that also reflect plant health.

#### c) Temperature Sensors:

Temperature sensor is a sensor which is used to measure the temperature information which can be presented in a readable form by using LCD panel or that can be transferred to another sensor. Temperature measurements will be monitored closely and the same will be communicated to the data center to perform the required actions.

#### d) Soil Moisture Sensors:

Soil moisture sensor is the sensor which is used to measure the water content retaining in the soil. It is the most important sensor in the field of agriculture because based on these sensors the farmers can manage the irrigation systems more efficiently by gaining the knowledge of how much water content is exactly required for the particular soil.

#### e) Pumping Sensors:

Pumping sensor is used to pump the water to the field according to the water level in the tank. Whenever water is enough in the tank and according to the moisture water will be pumped from the tank. The pumping sensor is used to automatically switch on the motor when there is not enough water in the tank.

In this project only pumping sensor, temperature sensor, and soil moisture sensors are used to provide information such as when to pump to water to the required plant, to provide temperature information, and to measure the contents of water respectively.

### IV. CONCLUSION

This paper talks about the various technologies and sensors which is used for the automated management of each and every plants in the farm without the human intervention rather than concentrating all the plants as equal. From the recent literature survey, it clearly describes that the management of plants are not automated but performs only the collection of all the real time data to the data center. It just sends the alarm messages and passes data for the analysis. In the existing automated system, pumping of water, sprinkling of fertilizers etc will be pursued equally for all the plants in the field, which will not be efficient as desired level of water and fertilizers for each and every plant varies. By concentrating each and every plant separately according to their desired level of water and the fertilizer content, the yield of crops will be better.

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