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MULTI-LAYER APPROACH IN AGRICULTURE CROPPING SYSTEM TO INCREASE PRODUCTIVITY USING SMART WIRELESS SENSOR NETWORKS

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Abstract: ***One billion people around the world are still under the border poor. Agricultural growth and productivity remains central to poverty reduction, particularly in the poorest countries like Pakistan, Bangla etc., where a large share of the population relies on agriculture and agribusiness for their livelihood. Hence, we there are some important parameters that should be monitored at a greenhouse in order to achieve good results at the end of the agricultural production. They are, temperature and humidity that are been commonly measured with manual methods. The wireless sensors networks (WSN) are defined as the collection of sensor nodes that perform a specific task and they are representing one of the technological solutions to automatize and improve the management of crops. This paper tries to propose such system so that we have better productivity. The proposed system is explained through India, however it would be applicable to entire world.***
Keywords: MANET, WSN, Agriculture, Sensors, Layer

1. Introduction

Starting with India since it has large population, it had a large and diverse agricultural sector, accounting, on average, for about 16% of GDP and 10% of export earnings and arable land area of 159.7 million hectares is the second largest in the world, after the US. India is among the top three global producers of many crops, including wheat, rice, pulses, cotton, peanuts, fruits and vegetables[2]. As one of the application of Wireless Sensor Network (WSN) in precision agriculture assists the farmers to know about their fields in statistical manner, which helps them in making better and accurate decisions. There are various type of sensors that can be used to calculate the statistical parameters of an agricultural fields, which convert the event or a phenomenon into an electrical or measurable quantity [3]. Evolution of WSN technology enabled automatic irrigation in a greenhouse for Precision Agriculture (PA) application. Sensors are used to monitor temperature, humidity and moisture. Software monitors data from the sensors in a feedback loop which activates the control devices based on threshold value. Implementation of WSN in PA will optimize the usage of water fertilizer and also maximised the yield of the crops [4].

1.1 Need

The proposed technique may not be required immediately but it is very much essential in later period of time, it will be helpful for farmers especially small size land holders. It also helps highly populated countries like India, China etc.

1.2 Problem statements

Considering the current population of India, we will be observing the heat from land shortage, delay in growing crop, slow agricultural growth etc. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and almost universal lack of good extension services are among the factors responsible. Farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation.

Hence, we need a better technical advisory system in agriculture and it can be filled by an efficient and smart Wireless Sensor Network.

1.3 Aims

As we know, the productivity of Indian farms is below that of Brazil, the United States, France and other nations. Indian wheat farms, e.g, produce about a third of the wheat per hectare per year compared to farms in France. Hence, we need a challenging technical system to the agriculture field to increase the productivity and be stay in the top of world !

1.4 Objectives

The objective of this project is to achieve a high productivity in agriculture by implementing a layer based technique where each layer is formed with a crop growing soil and placed on top of another layer. WSN is used to self access the whole set-up by monitoring the layers and its associations. There are few basic guidelines for deploying Wireless Sensor Networks (WSNs) in Agriculture, especially in crop monitoring. Firstly, it reviews the main components that existing WSN applications use, namely node platforms, operating systems (OSs), power supply, etc. Based on these data, a generic guide is proposed discussing basic considerations for deploying WSNs in applications relevant to agriculture [5].

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2. Research Method

In this section, detailed research techniques has been discussed. In the given land, need to prepare stipulated sizes of soil based plates, the architecture or the imaginary figure is shown in Fig 1.

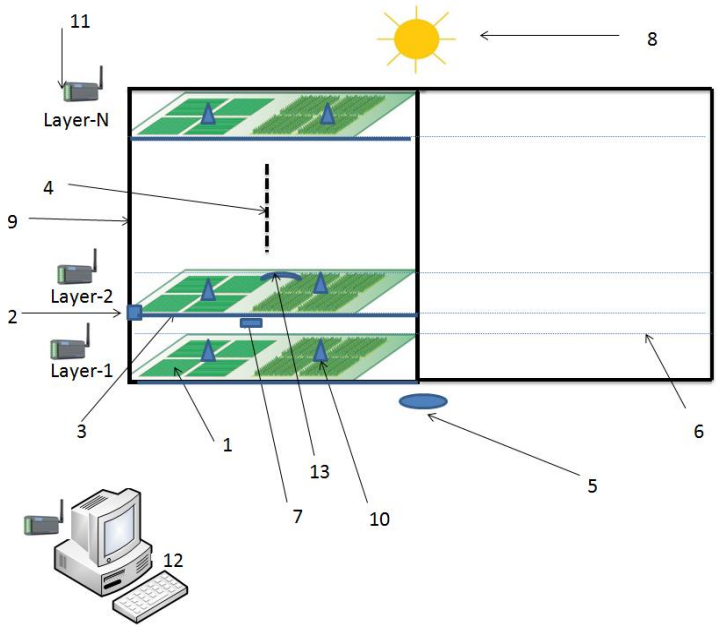

Figure 1: Multilayer Agriculture Architecture

Parts of this figure is listed below,

1. **Crop**: A cultivated plant that is grown on a large scale commercially, especially a cereal, fruit, or vegetable.
2. **Corner Container Holder**: It is used for sliding up and down. Here you can place automatic sliding machines.
3. **Soil Layer**: Layer is nothing but a solid plate which holds soil on top of it.
4. **Plates**: N-Number of Soil Plates.
5. **Storage**: In ground, water, fertilizers(use Fertikit) are stored.
6. **Horizontal Sliders**: Plate sliding metal pipe(Horizontal sliding).
7. **Artificial Light**: Artificial Photo Synthesis system can be used.
8. **Sun Light**: This is for natural Photo Synthesis.
9. **Vertical Sliders**: Plate sliding metal pipe(Vertical sliding)
10. **WSN**: Sensor Nodes/Devices (Transmitters Receivers and Repeaters).
11. **Node**: Base Node or header node for particular Layer.
12. **Super System**: Super Node monitored by end user.
13. **Equipments**: Drip and Sprinklers Equipments. Suitable for any landscape, Most water efficient technique, can focus on roots, can be mixed with fertilizer and pesticide.

Sensor Nodes/Devices (Transmitters Receivers and Repeaters) can be classified as, all are self explanatory.

1. Soil Moistures Sensors Soil moisture sensors used to compare water in different irrigation techniques.
2. Operational And Hydraulic Sensors
3. Plant Parameter Sensors
4. Environmental Sensors
5. Mist Guard Sensors
6. Weather monitoring station Temperature & relative humidity, Wind speed & direction, Precipitation (rain volume), Light intensity.
7. Pressure sensors This is used for water in irrigation pipes.
8. Water level sensors This is used for determining the change in near by water reservoir.
9. Temperature sensors
10. Humidity sensors
11. Wind sensors
12. Rain sensors
13. Soil Moisture sensors
14. Light sensors

The above mentioned sensors will be participated in the WSN to manage the agriculture related activities. In such system, crop selection can be considered based on the following parameters,

1. Season oriented crops.
2. Duration/term of crops
   (a) Short term, like methi, etc
   (b) Long term like ground net etc.
3. Benefit of crops
4. Cost to grow and maintenance of crop
5. Height of crop
6. Resources required for crop
7. Type of soil
8. Depth of the soil corresponding to crop.

The working scenario is as follows, firstly, all above information is preloaded for this project and started setting up the requirement. All horizontal soil plates needs to be arranged with a standard distance between plates in a vertical ladder. Appropriate seeds can be selected for these plates and applied on the soil, started watering and other stuff on this soil. Each soil plate will be exposed for sun light for particular (i.e. sufficient) time in a day and this is automatically calculated in the system like how long exposed or which plate needs to, strength of sun light, etc.

Humidity and other soil related parameters can evaluated using sensors and circulated through network to the central system. Like wise, we can evaluate crop size and it's maturity, etc. This entire system can automated using WSN by administrating through a central/super system.

We need to pull the required plate from the plates ladder and do the required work on this plate, once it is completed then slide back to the original position. Like this we can do this for all the plates if necessary. Few of the unknown things can evaluated/arranged while system is really setting up. Ultimately, this procedure/technique can fetch more productivity in the field of agriculture.

4. Conclusion

This paper has proposed an idea where agriculture and WSN helps to improve the growth and productivity. There are some important parameters that should be monitored at a greenhouse in order to achieve good results at the end of the agricultural production. They are, temperature and humidity that are been commonly measured with manual methods. The wireless sensors networks (WSN) are defined as the collection of sensor nodes that perform a specific task and they are representing one of the technological solutions to automatize and improve the management of crops. This paper tries to propose such system so that we have better productivity.

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