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EFFICIENT IMPLEMENTATION AND USAGE OF WIRELESS SENSOR NETWORKS IN PRECISION AGRICULTURE

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ABSTRACT

Sustainability and precision agriculture (PA) are two theories that are closely related. How global positioning system can benefit the environment, is a question that has been debated right from the moment it was first applied on agricultural equipment. Naturally, using pesticides and fertilizers as at when needed and where needed only ought to minimize environmental pressure. The facts on sustainability, precision agriculture and wireless sensor networks will be thoroughly discussed in this paper, since they are the next big thing in the field of Internet Of Things (IoT) and smart environment.

Keywords: Wireless Sensor Network; Precision Agriculture, smart environment

INTRODUCTION

Satellite data, wireless on-site sensors and gathering techniques have been established to be one of the most important needs of crop supply and supervision. Various studies and researches proved their relevance and possibility to solve different agricultural problems like crop forecasting, crop classification and planning, crop infections and micronutrient shortage and crop class and condition. Desire for precision farming[1] as well as the development of enhanced agricultural resources management systems has in recent times increased. The major aim of these somewhat new systems is to improve efficiency, increase profitability and promote environmental safety. Given the above, image-based remote sensing tool is significant in providing useful information that is not yet available to the realization of productive and sustainable agricultural practices. Farmers as well as agricultural supervisors are in particular interested in crop and soil condition measuring and appraising at specific important stages such as; initial growth stage so as to provide

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fertilizers in quantity suitable for a normal crop growth and then at an advanced growth stage for crop health observation and yield forecasting[2].

This work notes the necessity of the integration of Wireless Sensor Networks (WSNs) in the Precision Agriculture (PA) field and its implementation's potential challenges.

PRECISION AGRICULTURE

New systems have came up in the agricultural sector over the past few years[3]. Fortunately, precision agriculture is coming forth due to the growth in the wireless sensor networks field and the technological size reduction of sensor boards. PA aims at providing a medium of monitoring, assessing and managing agricultural practices[4]. It also sets the borders on preproduction and postproduction parts of agricultural activities. An aspect of precision agriculture focuses on location-based crop management based on sensors[5]. This covers so many areas such as soil, crop and weather monitoring in a specific field; theorizing the outcomes to a whole parcel; supplying a decision support system (DSS) for providing ideas for likely solutions, certain parts or every part of the field; as well as a means of taking different course of actions. E.g. changing in actual time, a procedure like; lime, fertilizer and pesticide use, sowing rate or tillage.

Precision Agriculture (PA) Site specific management (SSM) is about the efficiency and effectiveness of getting the right thing done at the right time and place. Though not a new principle however, in the 20th century, there was serious economic demand during agriculture mechanization to manage large fields with standardized agricultural procedures. Precision agriculture offers a means to mechanize SSM with the use of information technology which makes SSM feasible in commercial agriculture as mentioned in [6].

WIRELESS SENSOR NETWORKS IN PRECISION AGRICULTURE

Society can benefit greatly from the incorporation of sensors into agriculture, structures and the environment together with proficient delivery of information[7]. Its advantages includes; preservation of natural resources, minimal disastrous failures, enhanced productivity, better emergency response as well as enhanced national security. Though, limitations still exist in the extensive use of sensors in machines and structures. There are possibilities of connector malfunction and breakages of optical fiber tails and bundles of lead wires. Bundles of long wires means a major installation and a long time maintenance cost which could cutting the quantity of sensors that could be set up hence, reducing the value of reported data[8]. These costs can be removed by wireless sensing networks thereby, reducing setup and removing connectors. The suitable wireless

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sensor is scalable and networked ,use little power, resourceful, software programmable, swift in data acquisition, detail, correct, durable , affordable to purchase and setup with little need for maintenance. An understanding of the application and problem description is required in choosing the finest wireless communication link and sensors[9]. Battery capacity, size and sensor update period are all important in selecting a design. Temperature, peak strain captured passively and humidity are samples of low data rate sensors while vibration, strain and acceleration are examples of sensor with high data rate[10].

We propose the usage of WSNs in agriculture, as presented at Image1, in order to give a huge boost to the Precision Agriculture concept which can help many people improve their harvesting methods and produce products of a better quality.

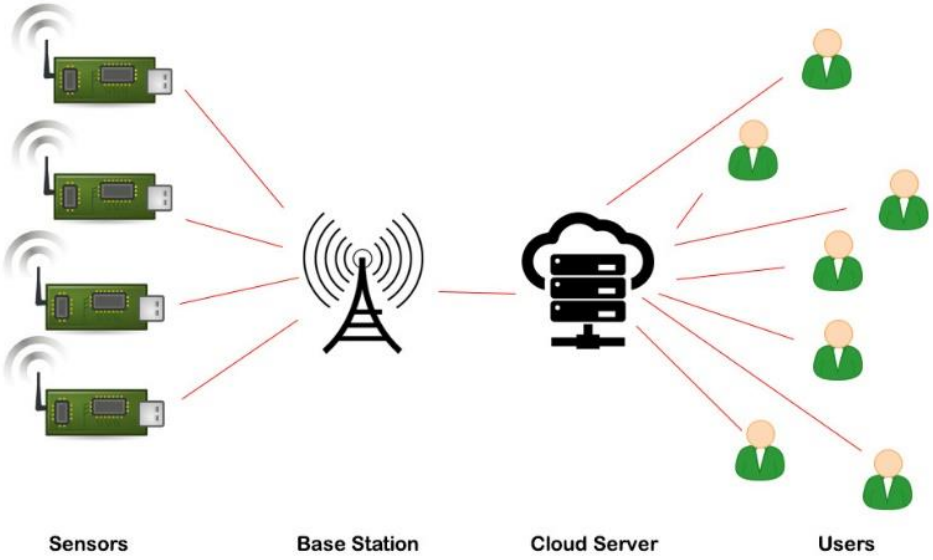

Image 1: Topology concept of WSNs in Precision Agriculture

CONCLUSION

As a final point, we can easily understand that Precision agriculture is an innovative concept that can transform the farming community and provide a more stable cropping environment, where quality and quantity will meet a great increase. Live monitoring, decision support systems and diseases pro action are only some of the most important aspects that PA can provide to the end users and ameliorate their work. As Future work we could point the security concerns that might come out of exhausted use of PA in agriculturists'' daily routines as well as the big data problems that could

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occur out of the continuous use of data collection through sensors. PA is a great sector that can help humanity re-invent its current methods and make them better.

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