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Integration of wireless technology in communication

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DESCRIPTION

An evaluation of several scenario cases of large-scale agricultural monitoring using Low Power Wide Area Network (LPWAN) based ground-level sensor nodes with tractor-farmer interactions is presented. The proposed scenario analyzed considers several communication links: node to infrastructure, node to tractor, node to farmer, tractor to infrastructure, and farmer to infrastructure communication. In addition, these scenarios are proposed for improving and tracking the performance of tractors and farm tools, and for resource management in the agricultural sector. Configurations of different connection types are tested, taking into account the effects of soil, spatial distribution, and infrastructure elements. The results show that LPWAN-based WSNs provide better performance in terms of coverage and wireless link quality results than ZigBee in large, uneven agricultural areas, both on ground-level fixed nodes and mobile tractors and farmers. It shows that you can do it. The proposed system will be validated by cloud-based platforms for Lora WAN, Sigfox, and NBIoT communications to provide a flexible and scalable solution that enables interactive agricultural applications.

The world population is predicted to succeed in 8.5 billion by 2030. This means that agricultural production needs to be increased. However, the increase in labor shortages in agriculture, especially during the recent COVID 19 pandemic, has led to the use of WSN in smart agriculture to address labor shortages, improve production quality and minimize costs. Evaluation and research on the benefits and challenges of the Internet of Things (IOT) in smart agriculture. In addition, research will be presented on security and privacy challenges and solutions in smart agriculture. When first WSNs were adopted in agriculture, most networks were supported short range communication technologies. A WLAN-based WSN for monitoring environmental parameters in the agricultural sector is presented.

However, deploying WSNs based on these technologies in large agricultural areas requires a large number of nodes to cover large areas and consumes a lot of energy, making the system expensive. Recently, Low Power Wide Area Networks (LPWAN) technology has become increasingly popular in the IoT market due to its low cost, low power consumption, and long-range wireless communication capabilities. Comparative research and research on the use of LPWAN technology in IoT applications. The most well-known LPWAN technologies are Long Range Wide Area Networks (Lora WAN), Sigfox, and Narrow Band IoT (NBIoT). As a result, LPWAN-based WSNs are widely used in a variety of areas, including: Air quality monitoring, intelligent health monitoring, Botanical Park monitoring, environmental monitoring, vehicle communication, etc.

Concerning LPWAN technologies in agriculture, some works are presented in the literature. An irrigation system based on Lora and Sigfox has been proposed. A combination of En Ocean and Sigfox for real time data collection for agriculture is proposed. An NBIoT based system for WUSN in potato crops is proposed. Other NBIoT based experiments for IoT in smart farming are presented. A Lora WAN based real time soil health monitoring system is proposed. In addition, we will give an overview of LPWAN technology in smart agriculture. The progress of agricultural technology is remarkable. Autonomous and semi-autonomous tractors are used for navigation, mapping, and monitoring. Several studies on autonomous tractor systems for video surveillance and mapping are presented in the literature.

Multiple scenarios are considered to supply different solutions for various applications in smart agriculture;

• The first scenario is based on near ground nodes to infrastructure communication using Lora 868 MHz, Lora WAN 868 MHz, Lora 433 MHz, Sigfox and NBIoT along with the classic ZigBee Mesh 2.4 GHz for comparison. The near ground nodes are placed on the bottom and at 1 m from the bottom round the farm field, sending

packets to the corresponding gateways and base stations, then to the clouds.

• The second scenario is based on ground node communication with the tractor in one case, and in the other case the coordinator's by having the tractor and farmer send ground-level data and store it in the Lora collect 868. Can play a role in MHz and ZigBee mesh 2.4GHz

• Finally, the last scenario is predicated on tractor to infrastructure communication in one case and farmer to infrastructure communication within the other case, where the collected data by the tractor and the farmer can be sent using Lora WAN, SigFox and NBIoT to the cloud. This scenario is also proposed for tractor tracking and monitoring systems. Real time autonomous tractor`s status as location, speed, fuel level and current tasks can be sent to the cloud for decision making. The measurements performed take into account the effect of the tractor on wireless communication.