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APPLICATIONS OF WIRELESS SENSOR NETWORKS IN AGRICULTURE: A COMPREHENSIVE REVIEW

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Abstract

At present, precision agriculture and smart agriculture are the hot topics, which are based on the efficient data collection by using wireless sensor networks (WSNs). However, agricultural WSNs are still facing many challenges such as multitasks, data quality, and latency. In this paper, we propose an efficient solution for multiple data collection tasks exploiting edge computing-enabled wireless sensor networks in smart agriculture. First, a novel data collection framework is presented by merging WSN and edge computing. Second, the data collection process is modeled, including a plurality of sensors and tasks. Next, according to each specific task and correlation between task and sensors, on the edge computing server, a double selecting strategy is established to determine the best node and sensor network that fulfills quality of data and data collection time constraints of tasks. Furthermore, a data collection algorithm is designed, based on set values for quality of data. Finally, a simulation environment is constructed where the proposed strategy is applied, and results are analyzed and compared to the traditional methods. According to the comparison results, the proposal outperforms the traditional methods in metrics.

Keywords: *Data Collection, Smart Agriculture, Sensor Networks, Wireless Sensor Networks (WSNs).*

I. INTRODUCTION

In this paper, authors proposed a wireless sensor network paradigm to detect the real-time forest fire monitoring. The wireless sensor network could determine and forecast forest fire more promptly than the traditional satellite-based detection methods [1]. In Mediterranean countries, forest and rural fires are one of the major causes of environmental degradation. Current systems for the detection of fire only concentrate on detection, but not on fire verification. In addition, the structures in the literature lack scalability. Almost all of them, though, are only simulations, and there are very few implementations to be found [2].

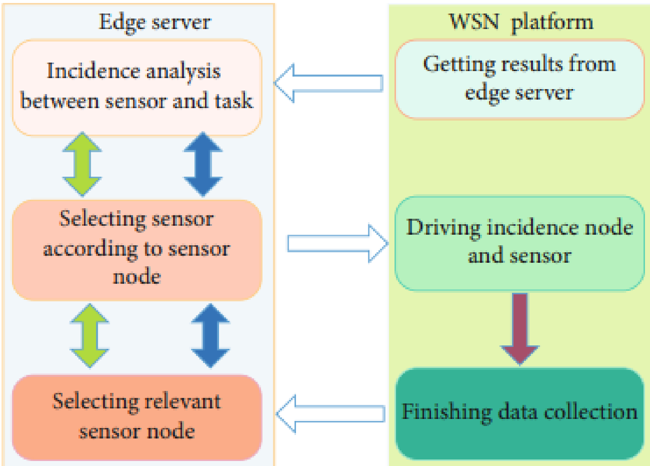

Fig. 1 Illustrates the framework for proposed architecture

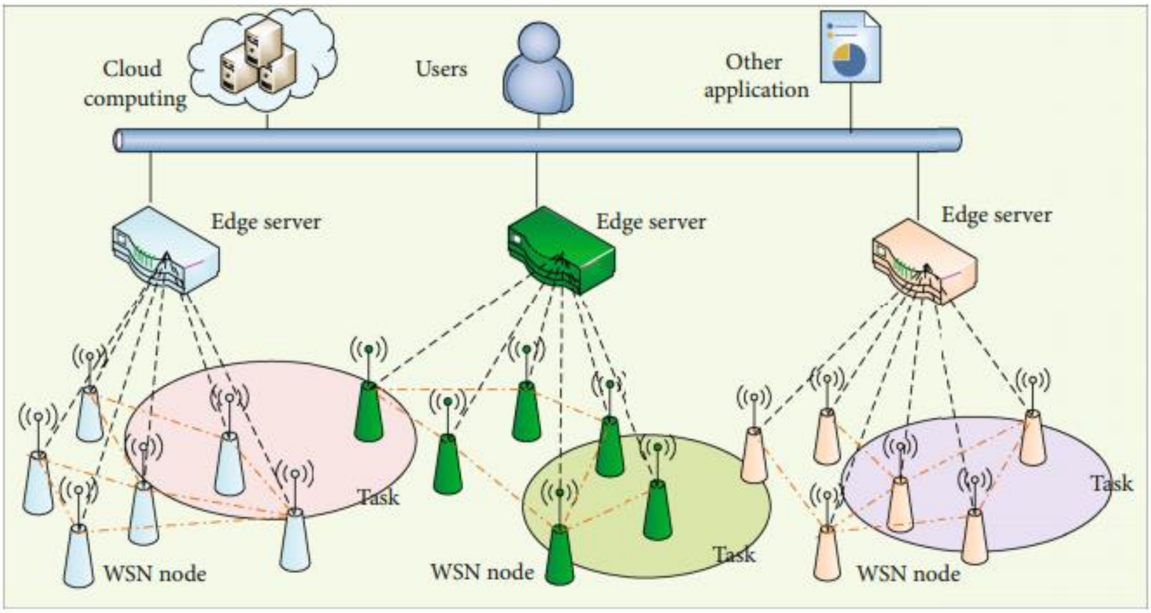

Fig. 2 Illustrates the connectivity through the wireless sensor networks

Wireless network technologies have become the cornerstone of modern precision agriculture monitoring, helping to collect distributed data, monitor in harsh conditions, accurately irrigate and supply fertilizers to generate profuse crop production while lowering costs and helping farmers collect data in real time[3]. Types of data on the targeted area were collected by the cooperative nodes that were carried out by embedded systems, which were then passed to the user. Figure 1 illustrates the framework for proposed architecture. Figure 2 illustrates the connectivity through the wireless sensor networks. Table 1 shows the wireless sensor network and its application.

Table 1 Wireless Sensor Network and Its Application.

Installation	Difficult to moderate	Easy installation
Time to install	More	Less
Mobility	Limited	Outstanding
User connectivity	Connectivity is possible only to or from those physical locations	Connectivity is possible beyond the bounds of physical network

II. LITERATURE REVIEW

Another paper on wireless multimedia sensor networks was carried out by Akyildiz et al. In recent years, the increasing interest in the wireless sensor network (WSN) has resulted in thousands of peer-reviewed publications. Most of this research is based on scalar sensor networks that quantify physical phenomena that can be transmitted via low bandwidth and delay-tolerant data streams, such as temperature, pressure, humidity or object location. The focus has recently shifted to studies to revisit the sensor network paradigm to allow multimedia content, such as audio and video streams and still images, as well as scalar data [4].

Another survey on the routing strategies in wireless sensor networks was performed by Zhang et al. Small nodes with sensing, computing and wireless networking capabilities consist of wireless sensor networks. Many routing, power management, and data dissemination protocols have been specifically developed for WSNs, where energy awareness is an important design challenge. Routing protocols in WSNs could differ based on the application and network architecture. Furthermore, these protocols can be categorized into multipath-based, query-based, negotiation-based, QoS-based, and coherent-based, depending on the protocol operation [5].

III. DISCUSSION AND CONCLUSION

In this paper, the authors presented forest fire detection in Zigbee projects that use wireless sensor networks to measure and transmit useful data in their architectures. A sensor node's function is to sense the environment, to transmit and to share sensory data with other nodes in the field. In digital transmission, the industrial application of wireless sensor networks to track

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temperature and humidity in the forest in a more timely and accurate way, we have highlighted unique advantages of data transmission security, network building versatility and low cost and energy requirements for a forest fire monitoring system. The wireless sensor network technology has a greater benefit compared to the conventional method of fire prevention, and there are wide prospects for use in forest fire monitoring. Research on the use of wireless sensor networks in the detection of forest fires abroad is still in the laboratory stage, and China's research in this field is even less limited to preliminary exploration of the layout of wireless sensor network nodes, topology, aspects of network security, and radio wave transmission characteristics in forest research. The propagation of electromagnetic waves is severely compromised by ground plants, trees in complex forest site environments.

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