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A Long Range Wide Area Network-Based Smart Pest Monitoring System

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Abstract : This paper proposes to use a Long Range Wide Area Network (LoRaWAN) for a smart pest monitoring system which aims at the oriental fruit fly (Bactrocera dorsalis) to improve the communication efficiency of the system. The oriental fruit fly is one of the main pests in Southeast Asia and the Pacific Rim. Different smart pest monitoring systems based on the Internet of Things (IoT) architecture have been developed to solve problems of employing manual measurement. These systems often use Octopus II, a communication module following the 2.4GHz IEEE 802.15.4 ZigBee specification, as sensor nodes. The Octopus II is commonly used in low-power and short-distance communication. However, the energy consumption increase as the logical topology becomes more complicate to have enough coverage in the large area. By comparison, LoRaWAN follows the Low Power Wide Area Network (LPWAN) specification, which targets the key requirements of the IoT technology, such as secure bi-directional communication, mobility, and localization services. The LoRaWAN network has advantages of long range communication, high stability, and low energy consumption. The 433MHz LoRaWAN model has two superiorities over the 2.4GHz ZigBee model: greater diffraction and less interference. In this paper, The Octopus II module is replaced by a LoRa model to increase the coverage of the monitoring system, improve the communication performance, and prolong the network lifetime. The performance of the LoRa-based system is compared with a ZigBee-based system using three indexes: the packet receiving rate, delay time, and energy consumption, and the experiments are done in different settings (e.g. distances and environmental conditions). In the distance experiment, a pest monitoring system using the two communication specifications is deployed in an area with various obstacles, such as buildings and living creatures, and the performance of employing the two communication specifications is examined. The experiment results show that the packet receiving the rate of the LoRa-based system is 96% , which is much higher than that of the ZigBee system when the distance between any two modules is about 500m. These results indicate the capability of a LoRaWAN-based monitoring system in long range transmission and ensure the stability of the system.

Keywords : LoRaWan, oriental fruit fly, IoT, Octopus II
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