A LoRaWAN-based IoT Platform for Smart Irrigation in Olive Groves - Abstract

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Summary

Irrigation is the major cause of water consumption in agriculture. It contributes to increasing crop productivity, but it is also a means to the preservation of water resources. Therefore, advancing the rational exploitation of water through smart irrigation in agriculture is essential for improving crop yield, decreasing costs, and contributing to environmental sustainability. The intense use of Information and Communication Technologies (ICT) has the potential to reduce the amount of water supplied to the crop. The Internet of Things (IoT) is the natural choice for irrigation applications, even though the integration of different hardware, software and connectivity technologies required for making it work seamlessly in practice, while keeping the cost at reasonable levels, is still at an early stage. Low-Power Wide-Area Access (LPWA) is considered an emerging class of connectivity technology, encompassing radio protocols capable of covering large geographic areas, while delivering multiple years of operation for devices running on batteries with a single charge. LPWA technologies have the potential to provide a step change in the enablement of energy efficient IoT applications. In this respect, LPWA networks are currently one of the most suitable approach for end-to-end connectivity in the farming domain. LoRaWAN is probably one of the most promising LPWA technologies, which offers long range, low power consumption, and secure data transmission, over license-free frequency bands. It can achieve data transmission ranges up to 15 km in open areas using a single gateway, and is supported by a wide community of industrial players, academics, IoT makers, and software developers.

In this paper, we propose a prototype LoRaWAN-based quasi-smart water management platform for irrigation, deployed in an olive grove of the Peta village of Achaea Region Unit. Since the water needs are directly linked with the soil moisture, we propose an IoT system for regularly and reliably monitoring the status of soil hydration and reporting it to a centralized entity for further processing. The system is built upon customized IoT hardware based on low-cost microcontrollers with embedded sensor interfaces and telecommunication modems, open-source software,

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open and standardized data transport protocols, and keeps capital and operational expenses at low levels. IoT end-nodes are deployed in the olive grove. Each node: i) collects soil moisture samples at various depths, i.e. at 30cm, 60cm and 90 cm, with a period of 20 minutes, ii) is battery operated with a lifetime of several months under a single charge, iii) an RF harvesting board is also deployed in each node providing an additional alternative for charging batteries and iv) uses the LoRaWAN for connectivity. A LoRaWAN gateway deployed in an adjacent warehouse due to power supply and weather protection. The gateway collects the sensor measurements from the IoT nodes and forwards the information to a cloud-based infrastructure using 4G connectivity. Data is finally stored in a database and can viewed from any Internet-connected user, in real-time, through dashboards. At a later stage the collected data will be used for creating smart irrigation policies, apply them in the olive grove and evaluate the corresponding water savings. The proposed platform presents several novel features in terms of hardware integration, operational options and connectivity support.

Keywords: Olive groves; IoT; LPWA; LoRaWAN; Irrigation.

JEL Codes: Q26, M35; L12.