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Low cost center pivot irrigation monitoring systems based on IoT and LoRaWAN technologies

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Abstract:
An increase in the irrigation demand has been projected in Europe, especially in the countries with the highest proportion of irrigated agricultural areas, such as Italy and Spain. This has led to advances in the field of irrigation systems, as center pivot systems which have facilitated the labor of farmers because of their automation. However, the monitoring of these systems together with the early detection of problems in their operation has become a key aspect during a farmer campaign. To answer this need, different solutions have been proposed from the ICT area and the Precision Agriculture field. In this work, the main communication and sensor technologies used for monitoring irrigation with pivots are analyzed. Two low-cost systems based on IoT technologies, GPS and LoRaWAN are proposed for the monitoring of this type of irrigation systems. Finally, the results obtained after its installation in two maize crops are presented and the conclusions obtained after the use of both systems are discussed.

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Contents

I. Introduction

According to Eurostat [1], Spain and Italy are the European Union countries with the most irrigated agricultural areas. This means that in recent years farmers in these countries have invested in the installation of irrigation systems such as center-pivot irrigation systems, which also allow to automate their work [2]. These systems facilitate the daily work of the farmer during the campaign and make possible a high degree of uniform irrigation on the crop. However, these systems are not foolproof and are subject to failure during their operation. Among the possible problems that can be found, there are those related to drops in the current water pressure in the pivots making them stop. This poses a problem for farmers who depend on a time slot of available water as because of this, they lose the time available to irrigate the crop. Another possible problem may be due to the obstruction of the path travelled by the pivot, making it keep watering in a particular area or stop for safety. For these reasons, from the ICT and the area of Precision Agriculture, there has been an increase in the development of solutions aimed at monitoring this type of irrigation systems, relaying the information produced by these systems and notifying the presence of any problem. This paper reviews the automation of these irrigation systems, the communication that these systems can present nowadays, and two low-cost systems are proposed to monitor this type of irrigation systems based on GPS positioning and LoRaWAN communication. Both systems have been deployed in two plots with central pivot irrigation systems to evaluate their efficiency. After their implementation, the results obtained and the main advantages and disadvantages of this type of system compared to existing systems in the literature are discussed.