Agro Smart

IoT Autonomous Irrigation System

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Abstract — **Nowadays, it is common to see irrigation systems wasting water, because of the quantity used, because the irrigation system stays on even when it is raining or when we know it is going to rain that day. This paper presents an irrigation system set on an IoT platform, it is possible to act in real time accordingly to the atmospheric/weather conditions. So, through parameterized and automated systems, it is possible to stop the irrigation plan of a garden, green space, or agricultural land. Later, using sensors, the system may or may not be activated in case the levels of soil moisture and luminosity do not respond to the parameterized needs. It is an efficient and sustainable solution that is available for all agriculture irrigation systems. To test the solution, unit tests were made, and a group of tests with all sensors connected was also done. This system implements an alternative method for the data flow and its monitoring, including that the system is aware of the user. The proposed system proved to be efficient and fulfilled the requirements.**

Keywords - LoRaWAN; ThingSpeak; The Things Network; Android App; Ubiquitous System; Smart Irrigation; Internet of Things.

I. Introduction

The overuse of water resources derived from growing per capita use [1] and inefficient use continue to represent serious problems. Climate change scenarios may also accentuate some of the scarcity problems in the future [2]. Intensive agriculture, urban growth, and industrial proliferation are also responsible for the contamination of water, reducing the water availability. So, a system was developed to reduce the waste of water resources and to autonomously monitor and activate the irrigation system considering captured data such as soil moisture and light, among others. Consequently, there will be irrigation only when the culture needs it. So the system prefers night irrigation, only when soil moisture levels justify it. In the development of the system the dimensions of sustainability were considered [3] and the project followed good practices for sustainable development. According to [4] and based on the Karlskrona Manifest, sustainability is systemic, sustainability has multiple dimensions and transcends multiple disciplines, applies to a system as well as its contexts, requires action on multiple levels, system visibility is a necessary pre-condition for sustainability design, and requires long-term thinking. The work under study represents a different strand of data than others presented. The paper is structured in 6 sections. Section II discusses the state of the art. Section III exposes the system design, particularly the requirements analysis, the characterization of the ubiquitous system, the functional and non-functional requirements, and the sequence of activities. Section IV depicts the developed system, the architecture, the LoRaWAN network, the sensorial network, the management platform, the client application, security, and hardware components. Section V discusses and analyzes the results. Finally, section VI where conclusions are drawn from the developed work.

II. State of the Art

The implementation of technology in agriculture is not a recent topic. Over the years, models have been designed and projected to increase efficiency and minimize human labor. No system is ideal, so the study, and improvement of the developed work becomes essential. This chapter will address related themes, the strengths and weaknesses of the work developed by other authors and draw conclusions.

A. Related Work

A comparative analysis between the related work was performed, where characteristics such as system communication, network topology, autonomy, microcontroller, intelligence, complexity of the sensor network, final client application, storage, actuators used, communication time, and system purpose were analyzed in Table I. In the papers under study, a variety of systems were implemented, each with its own strengths, but with the purpose of monitoring the environment for the growth of the plantation and its irrigation. The article [5] addresses an IoT system in a tomato greenhouse in Russia, the presented work relies on a reinforcement learning system. The article [6] features a weather forecast to turn the irrigation system on or off. The article [7] extols LoRa technology as opposed to other systems. The article [8] cites the cloud services architecture for a LoRaWAN network. The article [9] features a PH sensor to measure soil basicity and provide an additional planting monitoring feature. The article [10] serves the irrigation of different crop types and analyzes root depth. The article [11] makes use of a tank for water storage for planting and uses Firebase for data storage. The article [12] uses a WiFi ESP8266 module to monitor and turn on irrigation. The article [13] does plant growth monitoring with the aid of 2D/3D image processing. The article [14] names the advantages of applying the Internet of Things in the agricultural world, while the article [15] names the benefits of wireless sensor networks (WSN) in the same context.

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