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# An Automation Proposal with the Use of the Arduino Platform in the Rational Use of Water in the Irrigation Process

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**ABSTRACT**

The rational use of water is a practice that seeks conscientious and controlled consumption, which uses the natural resource only as necessary for each specific activity. For the improvement of the practice, the help of new technologies is important. The objective of this work was to present the results obtained with the use of an Arduino prototype in automated irrigation, to contribute to the development of automated systems in the rational use of water. Thus, it was sought to use only the necessary amount of water for the plant in the irrigation of the system. The work reveals an applied nature, a qualiquanti approach and an inductive scientific method. Tests were carried out to verify the functioning of the prototype, up to operation during a period of 60 days with readings every 1 hour. The parameters to define the intervals for wet soil (0 -- 500), and dry soil (501 -- 1023) were adopted from the values provided by the manufacturer of the moisture sensor used in the project. As a result, the soil remained within the ranges for dry soil and wet soil without acute values for both. It is concluded that irrigations were carried out in times of dry soil without water supply to the plant in times of moist soil. The rational use of water in the irrigation system in which the prototype was applied was put into practice.

**Keywords:** Rational Use of Water; Arduíno; Irrigation

## Introduction

Water resources on the planet are depleted year after year, affecting different social spheres, because in addition to the pollution of rivers and springs, unsustainable and irresponsible consumption in economic development becomes a relevant factor for the reduction of water in the world (DETONI, et al. [1]). According to (Suzuki [2]), after research results and studies carried out by the National Water Council, in the Brazilian Northeast, 70% of the 1,300 semi-arid municipalities may have water supply problems by 2025, with a population of 30 million who run the risk of suffering a water crisis by then. Water is an indispensable natural resource for life on the planet, used for different purposes and with a significant role in economic and social development (FOLLMANN, et al. [3]). In Brazil, water is used for various activities, the main use being irrigation, followed by others such as: supply, industrial purposes, power generation, mining, agriculture, navigation, tourism and leisure. For each use there are particularities related to the quantity and quality of water, which can change the natural conditions of surface and groundwater linked to the resource extraction points (ANA [4]) The rational use of water is a topic debated in international forums related to the environment, technologies that can reduce or avoid waste are fundamental in activities that use this resource. According to (FAO [5]), world agriculture

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consumes 70% of the total water consumed by the planet, in Brazil this number becomes 66% for agriculture and food, a number that grows in less developed regions (IBGE [6]).

Water is an important resource in the country's energy matrix, in the generation of electricity, since according to (EPE [7]) 64.9% of the electricity generated in Brazil comes from the hydraulic source, therefore, with expressive numbers for the consumption of water for irrigation and with the energy relevance for the country, there is a need for technological advances not only in agriculture, but in several areas to save energy and water consumption, thus, there is the possibility of an individual and direct effect in the water-energy consumption ratio. Irrigation is an artificial technique used to distribute water in different ways, such as replacing what was consumed by a plantation, lost by evaporation, infiltration and transpiration, which can guarantee the presence of one of the most important components for the development of the plant, works to provide the necessary amount of water for its growth (TESTEZLAF [8]). Given this scenario, the opportunity arises with automation systems, technological solutions and strategies that enable the more rational use of these resources. Automation can be defined as the set of technologies, knowledge and equipment that allow operating processes autonomously and without human intervention (CASTRUCCI, et al. [9]). Automation combines equipment such as Programmable Logic Controllers (PLC), digital and analog readings provided by sensors and the command of actuators that execute the actions of the controlled process, in addition to providing a ``telemetry'' of the system. One of these technologies that can be used in automation is the Arduino, which can help the practice of rational use of water in irrigation means, or activities with relevant use of water on the world stage.

Nowadays, it is noticed the insertion of such technologies in different agricultural segments, for example: in the production of vegetables, fruits and greens, in which it is intended to develop an automated irrigation process. According to (McRoberts [10]), the Arduino is a small programmable microcontroller to process inputs and outputs between the device and the external components connected to it, it is known as a physical or embedded computing platform, a system that can interact with its environment. through hardware and software.

## Material and Methods

Before assembling the project, the FRITZING 0.9.9 software (https://fritzing.org/download/) was used to create a schematic prototype with its circuit connections, also in this software, there is the option of using it as system operation simulator, just insert the programming code. The choice of the FRITIZING 0.9.9 software was due to the availability (freeware) of the components and the ease of importing them into the project (Figure 1). The developed prototype can be seen in Figure 1 with the Arduino MEGA and the peripherals that make up the system, which allowed performing all the irrigation management functions, activating and deactivating the solenoid valve based on the reading values and the predetermined time in the schedule. In this case, the relay acts to energize and open the solenoid valve at 12v, for the 2s time already programmed by the algorithm and thus promote irrigation. After this time, the valve closes and the system takes a new reading at an interval of 1h, if the soil is still dry, the actions of the irrigation system are repeated until a reading in which the processed value is within the interval for wet soil (Figure 2).

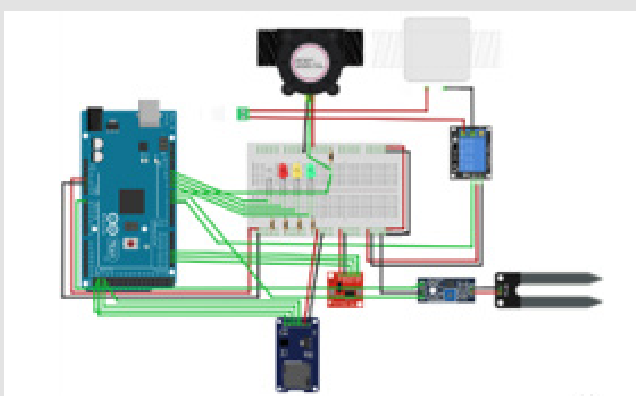

**Figure 1:** Circuit diagram.

Note: by author (2023).

**Figure 2:** Presentation of the prototype.

Note: by author (2023).

## Conclusion

The range of intervals used in this work was the sensor standards maintained by the manufacturer. It was verified that in its operation the model offered the necessary amount of water to the plant, since the results generated from the irrigation data did not show, in any interval, acute values of humidity after opening the solenoid valve, as well as they did not present intervals long with values for dry land. Thus, the plant was kept in ideal growing conditions during the 60 days. Therefore, the rational use of water was put into practice during the experiment period. The intervals for measuring humidity may vary according to the crop in which the prototype is applied. For these intervals, local characteristics must be observed, such as climate variables (temperature, relative humidity, atmospheric pressure, rainfall or precipitation), soil type and crop. A marketable product of affordable technology for automating irrigation and management based on soil water potential has shown promise.

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