LOW COST SYSTEM BASED ON INFRARED TECHNOLOGY FOR WATER MANAGEMENT

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Abstract. Water is an essential element in the life of the human being for which its conservation and good use is necessary, in this work we make a proposal for the development of a low-cost system for water management in order to save on Its consumption, using infrared technology, the results provide a mechanism that can be replicated and at different scales, by the use of commonly used devices.

1. Introduction

Definitely, Peru is in a situation of greater risk than many countries. The reduction of its glacial ice by between 30 and 40% is a cause for great concern and puts many productive activities at risk. [13]
In the first semester of this year, it is estimated that there are 31 million 488 thousand 600 people in the country. Of this total, 86.1% access water through the public network, (67.1% drinking water and 19.0% non- drinking water) and 13.9% consume non-drinking water from the river, spring, rain. Tanker or pylon for public use. That is, there are 10 million 359 thousand 700 people (32.9%) who consume non-potable water in the country, of which 5 million 982 thousand 800 (19.0%) correspond to the population that has water from their homes public network and 4 million 376 thousand 900 (13.9%), to people who consume water from other sources (river, spring, rain, tank truck or pylon for public use) [14].

Through the qualitative study it has been proven that people have heard of global warming, and therefore of climate change, however that is not enough for awareness of water care. To achieve a real effect on behavior change, it is necessary to convert the diffuse knowledge about water scarcity in a specific situation and at the same time relate it to the activities of people, so that they feel identified [3].

Access to quality water is directly related to the life and health of populations, especially when it comes to rural areas. Every year, about 10.6 million children die worldwide before their fifth birthday, of which, according to the World Health Organization (WHO) and UNICEF, about 2 million die from diarrheal conditions [15].

analyze about normal water which contains particulate matter including includes particulate matter, parasites, bacteria, algae, viruses, fungi and a variety of dissolved and particulate matter derived from surfaces, with which the water may have made contact after falling in the form of rain, contaminating domestic water which can cause water-borne diseases such as cholera and diarrhea, for which a purification system has been developed with a proportional-integral-derivative (PID) controller located in the tank. water storage facilities in cities, controlling the pH of the water, the clarity and the presence of microorganisms in the water, for which it has used alum treatments followed by filtration for clarity, treatment with UV rays and chlorine for disinfection and acetic acid / alum, sodium carbonate for pH control [1].

In this research we analyze about water considered as a prerequisite in human life, so it looks for mechanisms to energetically test the quality of drinking water in real time, for which a low-cost system for monitoring and control has been proposed. of water quality in real time using IoT, it consists of physicochemical sensors that measure the physical and chemical parameters of the water such as temperature, turbidity, conductivity, pH and flow, where doctors detect the contamination of the water, evaluating the values of the sensor processed by Raspberry pi and sent to the cloud, where the data is sent to the cloud and the flow of water in the pipe is analyzed through IoT [2].

Quality of drinking water and the economic income of the population: Referring to costs associated with supply - and the right to receive information on water issues. Rural and indigenous populations in developing countries do not access drinking water services or, when they exist, do not meet the quality requirements for human consumption (Defensoría Del Pueblo, 2007) [16].

The World Health Organization develops the parameters regarding the minimum quantity and quality of water for human consumption (World Health Organization, 2006) [17].

Studies by this organization indicate that in developing countries 80% of diseases and more than a third of deaths are due to the consumption of contaminated water, in addition to the fact that 60% of infant mortality in the world is linked to infectious diseases [19].

During that period, Peru had a high growth rate (between 2002 and 2013 it was 6.5%) and a substantial reduction in poverty (from 54.7% in 2001 to 22.7% in 2014). However, the 'Peruvian miracle' did not fulfill everyone's wishes. A person needs a minimum of 50 liters of water a day to drink and wash, according to the World Health Organization (WHO). But while some in Lima have more than enough, most lack it. The average consumption in the Lurigancho- Chosica district in 2011 was 15.2 liters, in San Isidro 447.5 liters were spent [4].

Definitely, Peru is in a situation of greater risk than many countries. The reduction of its glacial ice by between 30 and 40% is a cause for great concern and puts many productive activities at risk. [5].
Water management to ensure the provision of basic services to citizens, for economic growth and to keep water environments healthy is ultimately the responsibility of governments [6].

Man uses it as an element for his nutrition, either as a drink or as a food component, he requires it for washing junk and clothes; You demand it for the bathroom and you have it to remove your waste, provide comfort and solve many problems in your daily life by producing electricity and steam [7].

It is the most important abiotic factor on earth and one of the main constituents in the environment in which we live and in living matter [8].

Water is a limited natural resource and consequently a public good for life and health. More than a billion people lack adequate access to basic water supplies, while several million do not have access to adequate sanitation, which is the most important part of water pollution and water-related diseases [9].

It is estimated that by the year 2025, approximately 1.8 billion people will live in countries or regions with a drastic lack of water, and two thirds of the world population could be totally without this resource [10].
A call for a World Water Convention to preserve an essential good to which everyone has a right. It also calls us to mobilize for an immediate program that provides water to poor rural and urban areas [11].

The important thing is to identify which water sources are the safest and from there try to improve their quality and access [12].

Despite the high levels of coverage indicated in official statistics, these chronic deficiencies asymmetrically and unfairly affect vulnerable rural and urban populations residing on the outskirts of cities. the lack of attention to rural areas, and the obstacles and the lack of incentives for the protection of water sources and the control of contamination [20].

2. Materials and Methods

2.1. Use of Infrared Technology

Infrared technology is a great contribution to science and more to electronics due to its ability to be used as a motion detector that uses electronic projects that benefit people's daily lives. Physical and mathematical calculations will be used to detect an object and convert the infrared signal into a sensor.
The Tx Infrared Diode when the infrared signal is cut off and reflected by an object is received by the Rx Diode, which generates a small voltage at its output.

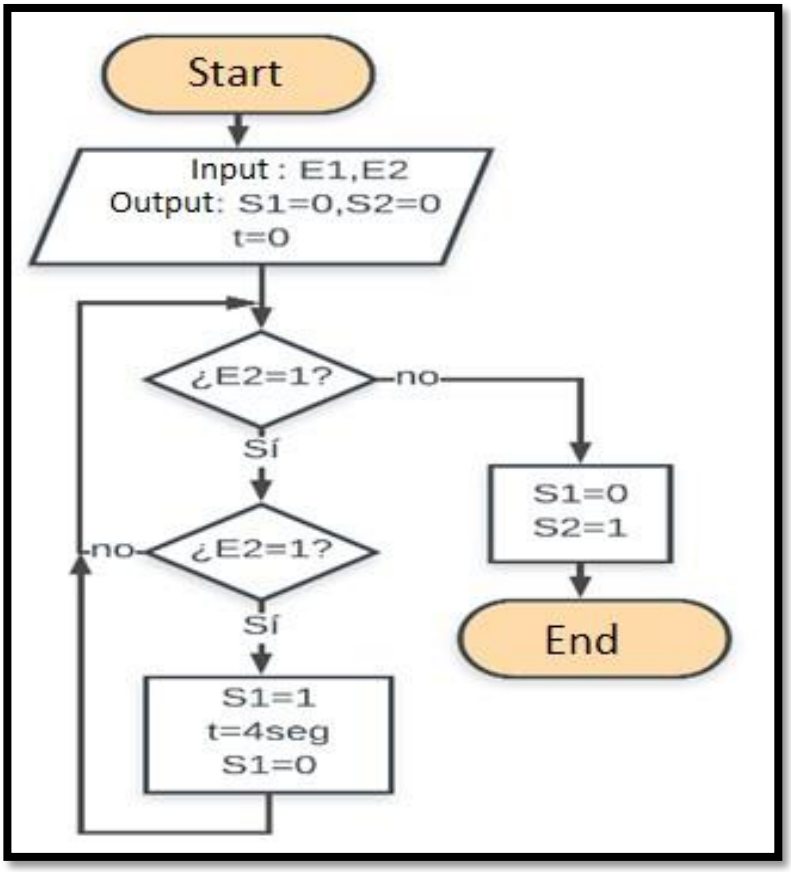

Figure 1: Flow Diagram Created for the Algorithm used in Programming the Arduino.

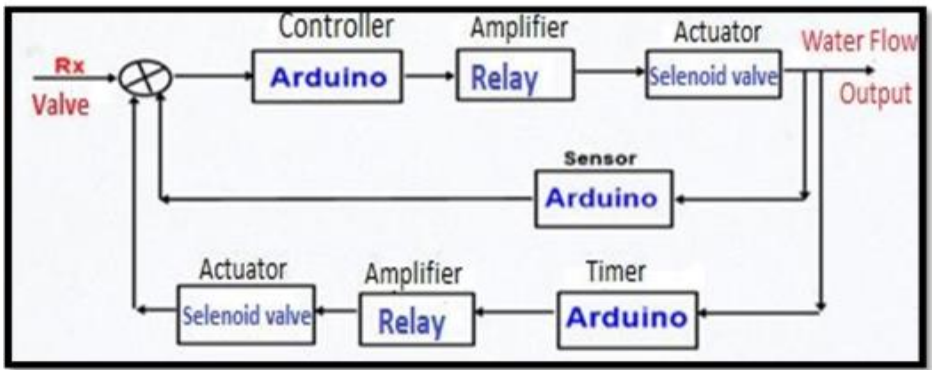

Figure 2: Closed Loop Control System Diagram.

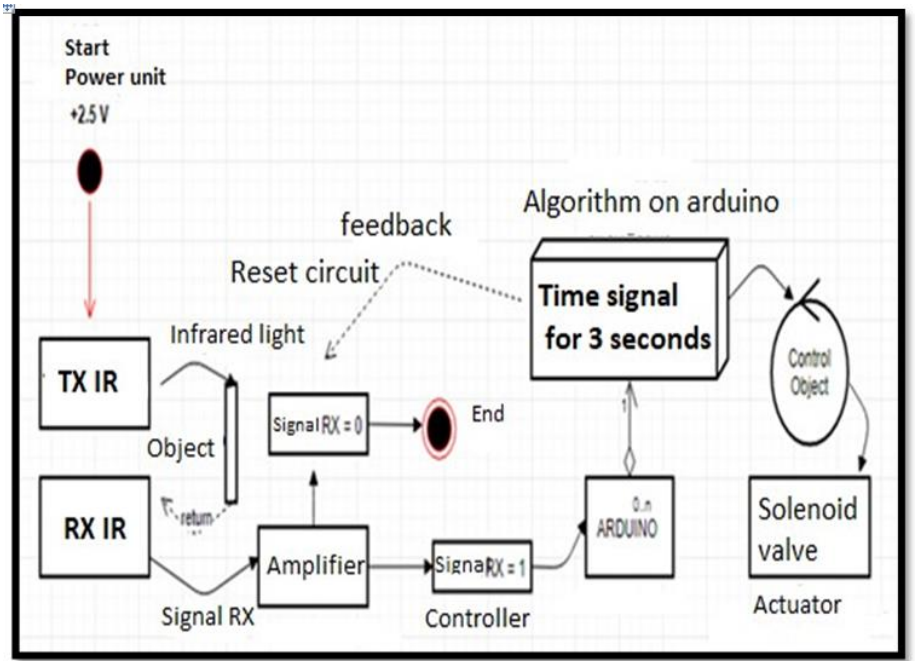

Figure 3: UML System State Diagram.

2.2. FUNCTIONING

The present project controlled through an arduino board an actuator, solenoid valve, with the help of infrared sensors. For the implementation of the project a free hardware board, arduino UNO, will be used, infrared sensors will also be used and finally we will use the solenoid valve as an actuator, which will be controlled through a relay. When the circuit is powered by 5v, this will make the Transmitter IR diode emit the infrared electromagnetic spectrum indefinitely, so when the user, after having soaped their hands, wants to rinse, they will put their hands under the spout, closing a circuit so that it reflects the infrared light towards the Rx receiver diode. This signal will be sent to the arduino, which will be programmed as a sensor that will send a 5v pulse as output to the 5v relay that controlled its own 12v output necessary to drive the solenoid

2.3. Water Saving System, Using Low Cost Timed Infrared Technology

valve and open for water to flow. But also the arduino is programmed as a timer that will only send the 5v signal for 3s and then cut the circuit, leaving the solenoid valve without power that will automatically close preventing the flow of water. The arduino after finishing this process will feed back the circuit because if the Rx diode if it continues to emit the signal, that is, the user continues to wait for the water to fall, it will not activate until the user withdraws his hands, then the arduino will restart the system to start over with the automatic process. Lastly, the circuit will detect water leaks due to valve wear by means of a fluid sensor that will trigger an alarm.

- Specifications of the Led Diode used with the calculations made:

- Type: Infrared light emitter

- Encapsulation type: transparent LED
- Led measurement: 5 mm
- Transmission angle: 27 °
- Wavelength: 940nm
- Maximum voltage: 1.7 V
- Maximum forward bias voltage: 1.3 VDC
- Continua Continuous direct current: 100 mA
- Peak current: 1 A
- Power dissipation: 20mW
- Operating temperature range: -40 ° C to 85 ° C
- Storage temperature range: -40 ° C to 85 ° C
- Soldering temperature: 260 ° C

Number of pins: 2

3. Results

The results are presented in relation to the different aspects that have been evaluated, from the study of costs, the materials used and the response of the methodology used.

- The materials used in the project are very cheap but achieve great results by mixing programming with electronic devices.
- It was possible to design arduino programming for communication between electronic and electromechanical devices.
- This project makes a great contribution to society by creating a practical awareness of the use and saving of water.
- The current generated by an infrared detector is a signal that this type of light exists. Infrared is a wavelength of light that is beyond the range of human vision.
- It was possible to create a closed loop system where the signal input from the infrared receiver sensor is sent to the arduino, which uses an algorithm to program the water fall for 3s, this is achieved with an actuator, which is a mechanical device that opens or closes the water flow but the system is fed back with the arduino because the operation is restarted avoiding external disturbances.

- It is recommended that the infrared light emitting diode be of good quality for good emission at the wavelength and that it have a minimum range of infrared light at a distance of 30cm.

- An electric solenoid valve can only function as an on / off device and cannot be used to gradually open or close the valve in applications where more precise flow regulation is required.

Although the light emitted by an infrared LED is not visible to the naked eye, most infrared LEDs have a purple covering around them. This helps transmit the correct color of light.
The wavelength of the light emitted by an infrared LED falls in the infrared spectrum. While this spectrum is quite wide, most LEDs will emit light with a wavelength of about 1000nm with a bandwidth of about 50nm. This means that an LED with a value of 1000 nm will produce light between 950 and 1050 nm.

4. Conclusions

Water is one of the most important elements for human life, influencing aspects of health, economy, food and others. That is why the good use of this element that ensures the life of every human being is recommended. The proposal contributes to the responsible management of this resource based on a technological innovation that will allow its best use. Its application depends on the investment made, therefore the contribution is in the design based on low cost so that it can be applicable and scalable on a large scale, it is intended that its use be massified for the benefit of water conservation.

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