

Prototype for Water Reuse in House Showers: Savings and Economics

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Abstract—The main purpose of this paper is to demonstrate the savings and economics of using an automated watering system within households. The paper will argue about a device capable of optimizing water consumption allowing water reuse. Device will be automated and will use an electric and mechanical system to redirect water to different reservoirs. System will make use of a wide diversity of sensors such as temperature, presence, and volume. Since project is being developed under Mexican investigators, this system is focused in Mexican values. Due to savings made on water bill it is expected to also have a monetary saving, making it a win-win to humans and the environment. It is important to resemble that all calculation within this article were made to solve the Mexican water scarcity problem, particularly in the City of Aguascalientes, but can also be replicated to any location. The city of Aguascalientes has water scarcity problems. Because of this an analysis was made in order to preserve this natural and vital resource as much as possible.

Keywords—domotics, economics, optimization, savings, technological development, water, water consumption, water reduction, water sensors.

I. Introduction

As far as is known water is vital for human and civilization development. Water has been fundamental from ancient times until nowadays. Water use has gone from basic activities such as human consumption and irrigation to industrial activities such as clothing dyeing, and various industrial processes. Water is one of Earth's most valuable resources. Earth's surface is covered by up to 70% of water. From that percentage, only 3% is potable and suitable for human consumption. Such 3% of potable water can be found in rivers, lakes, underground aquifers, and finally glaciers [1].

The following study and project was developed and though for the City of Aguascalientes, which literally might translate to hot springs, located in the geographical centre of Mexico [2]. By 1970, in order to find underground aquifers, it was needed to excavate up to 33 metres and by 2005, excavations grew in depth up to 145 metres [3]. That makes 4.39 times what it was excavated back in 1970. During this time, Aguascalientes' aquifers have suffered due to the increase of population and

industrial activities within the State. Both population and industrial growth have grown exponentially [4]. In 1970, there were 338,100 inhabitants in the city; by 2015, there were 1,312,500 inhabitants. That means in a 45-year period there was a population growth of almost a million people, 974,000 inhabitants exactly [5].

II. Related Work

In Aguascalientes, the problem of water scarcity is a sensitive issue. At a preoccupant rate aquifers are being emptied, recovering water is very expensive and takes a long of time to recover to its natural state. In addition to this problem water savings, water reduction and water reuse is a major problem.

Aguascalientes' municipality has launched several social programmes in an attempt to save water and promote its low consumption. Despite these attempts, there are not many people who get involved with them. On the other hand, existing water saving devices are expensive and not many households are capable of affording such devices.

According to recent studies in this field, the way most water is wasted is while bathing or showering. According to Mexico's National Water Commission, CONAGUA for its acronym in Spanish, the time when most water in Mexican society is wasted is during bath time. According to this State dependency, an average shower of 5 minutes is equivalent to 50 litres of water, or 13.21 gallons of water [6].

Due to this excess of wastewater, it is relevant to develop and implement new affordable technologies that might be able to save water and be environmentally responsible. In order to achieve the development of such device it is necessary to implement new technologies such as domotics.

Domotics is defined as the automation of homes. Such automation can go from the lights, HVAC systems (Heat, Venting and Air Conditioning), UPS systems (Uninterrupted Power Systems), and Security Systems, etc. It is necessary to say domotics is related to inmotics, the main difference is that the last one is the term used for building automation [7].

As told before domotics addresses home problems by using automation processes, but truth be told some automation devices are expensive, so there is a need to develop cheaper technologies and components in order to reach more homes and take advantage of its benefits. There is an opportunity

