Automated Smart Water Valve

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The desire to conserve the resources of water has prompted the creation of innovative approaches, such as the Automated Smart Water Valve. In response to the common problem of water waste caused by negligent faucet use, this study proposes an innovative technique that combines Arduino microcontrollers with Bluetooth technologies. Unlike traditional faucets, this automated valve system requires minimum user intervention, resulting in effective water consumption across multiple water containers. The device automatically regulates water flow using a solenoid valve and a float switch, reducing both the financial cost and environmental effect of unsupervised consumption of water. This study intends to give an outline for improving water conservation efforts in both residential and commercial settings by thoroughly analyzing its functions and deployment situations.

Keywords – Arduino, Sensors, Automated, and Bluetooth module

I.INTRODUCTION

a. Problem Statement

Automated Smart Water Valve is one of the convenient solutions created for humans to conserve water. Smart water faucets can solve various problems and this involves the cases on the use of water faucets that are being left open. This problem causes unexpected potential increase of water bill when left unattended and especially water wastage which is not an environmental sustainability. According to [1], households consistently had the largest share of expenses on water in the year 2020.

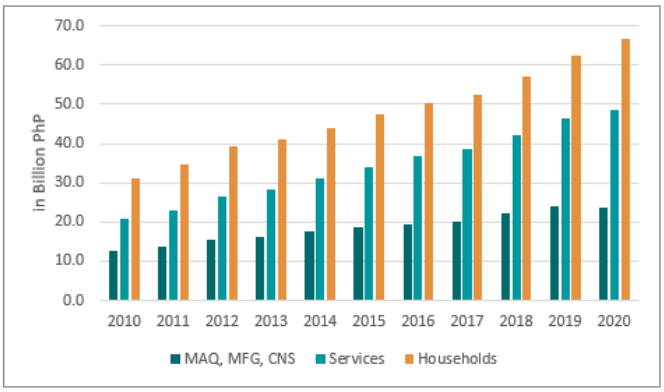

Figure 1: Water Expenses by Sector, 2010 to 2020

Water conservation solutions are implemented to mainly conserve water and prevent water wastage. There are available related existing solutions like smart water meters that measure and monitor water usage, water leak detection systems, and water float valves.

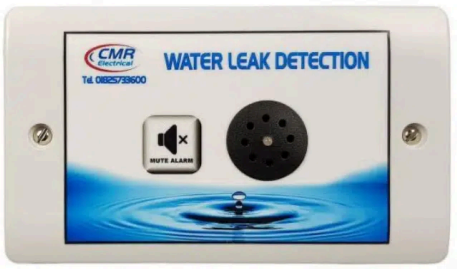

Figure 2: Existing Technologies

b. Project Overview

Our solution is an automated smart water valve that involves the integration of Arduino microcontrollers and a Bluetooth module for its connection. It can be used without the need for constant manual intervention, unlike the traditional water faucets. This allows the efficient usage of the water and automatically determines control over the water resources. This enables the device to be installed and used in different kinds of water containers for ease of use. This automated smart water valve can automatically shut off the water line with the use of a solenoid valve and a float switch to detect the water level. It has a water level indicator using an LCD to determine if the water bucket is full or not.

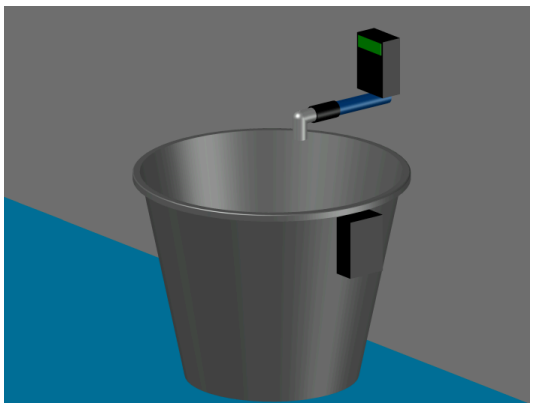

Figure 3: Concept Art of the Solution

c. Objectives

General Objectives should contain the general target of your project. To attain this, the following are to be accomplished:

- Design and implement hardware components, such as Arduino microcontrollers and Bluetooth modules, to provide seamless communication with present water supply systems.

- Provide software algorithms for automatic water flow management, including features like water level detecting and shut-down procedures.

II.METHODOLOGY

a. Hardware Design

i. Electronic systems

Our group focuses on ensuring the functionality of the smart water valve's features and its robustness. We also ensure its alignment with the design standards. Through the use of designing materials, we are able to construct the sketch of our prototype together with each hardware material placement. After planning and doing the sketch, we successfully assemble our prototype and ensure that it functions properly through various tests.

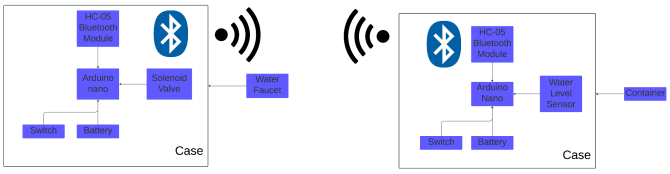

Figure 4: System Architecture of the project

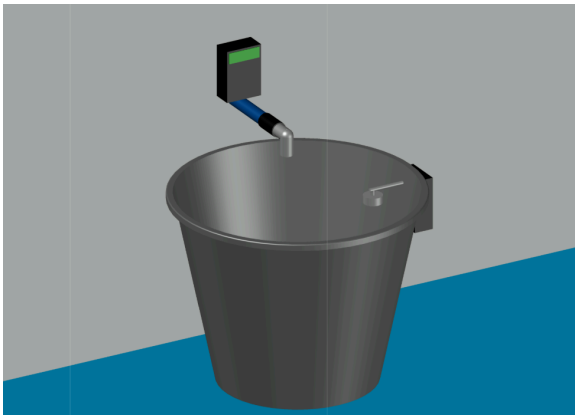

Figure 5: 3D CAD of the Prototype

ii. Physical systems

The device itself is enclosed by acrylic glass panels, which are wrapped by a vinyl sticker to cover. The control box holds all of the hardware devices that are needed for the project. It is also eligible for mounting in walls and attaching into a water container.

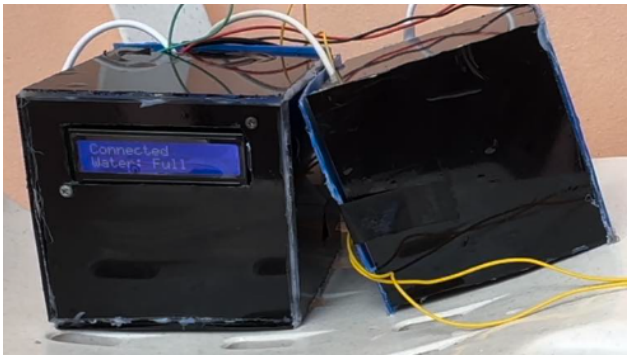

Figure 6: Actual Image of the Control Box

iii. Power Management

For the power management, this device uses a 5V line from a 5V source which is essential for the power input in the two microcontrollers. Another power source is coming from four 18650 batteries that are wired in series. This serves as the power source for the solenoid valve which requires 12V input.

Figure 7: Power Source for 12V input

b. Software

i. Embedded Software

Upon developing the software, we are able to construct the code for an automated water flow control which detects the levels. We use a master-slave model in order to enable a relationship and communication between the two bluetooth modules and microcontrollers. The code of the solenoid valve code implements an automated shut-off wherein it will detect whether the capacity goal is reached.

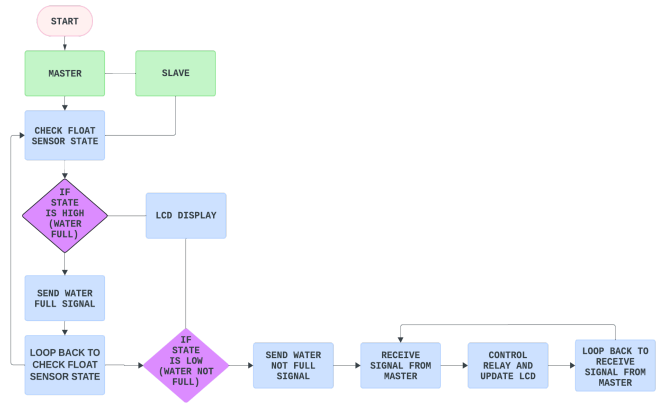

Figure 8: Flow Chart of the System

III.TESTING PROCEDURES AND RESULTS

a. Test Configuration

To test the prototype, we powered up all of the components in our prototype. And to validate the connection of the bluetooth modules, there is an LCD panel to show the status of connection.

For the main function of the prototype, we tested the sensor if it is sending the data to the other module. If it is sending the data, we now have to check the relay and the solenoid if it is closing when the water in the container is full.

b. Testing Results

Trial	Status	Intended Result	Actual Result	Result
1	Bluetooth is connected	The bluetooth module from the receiver and transceiver will connect	The two bluetooth modules are connected	Success
2	Water Not Full	The valve is open automatically	The water is flowing through the faucet	Success
3	Water Full	The valve will close to shut off the water flow	The water flow was shut off	Success
			Total	3/3

In the testing result, we conducted three types of tests. First test is the establishment of Bluetooth communication of the prototype. Second test is when the water from the container is not full. Lastly, is when the water container is full.

IV. ANALYSIS OF TESTING RESULTS

In the testing results, our group was able to determine the functionality and results of the Automated Smart Water Valve, where it successfully achieved the expected outcomes, which are to establish automated water flow management utilizing hardware system integration of microcontrollers and Bluetooth modules for seamless communication. The results illustrate the trials that we have conducted in order to examine the intended outcome of our prototype, which is also significant for further improvements.

V. CONCLUSION

Our group started to gather information on how we construct the structure of the prototype and to determine its functionality. The past activities on this term plays a significant role on us as it serves as a step by step procedure for us to accomplish our project. The software contains the functionality of the automated water flow control which also detects water levels and enables component communication. The solenoid valve code ensures automated shut-off when capacity is reached. Lastly, working on our hardware includes the configuration, testing, and improving of our prototype..

VI. RECOMMENDATIONS

The project's implementation could be further improved by adding more features such as an alarm or application that will notify users if the water bucket is full or not. Further development for sophisticated software implementation will be also seen to ensure reliable and optimized performance. Enhancement of the design of the case can be further improved to save space and be more compact.

VII. REFERENCES

[1] "Country's Overall Water Use Efficiency Decreased while Water Stress remains at Low Level | Philippine Statistics Authority | Republic of the Philippines," *psa.gov.ph*. https://psa.gov.ph/content/countrys-overall-water-use-efficiency-decreased-while-water-stress-remains-low-level

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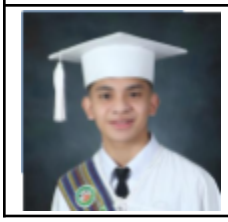	**Torres, Kurt Russel R.** 3rd Year CpE Student