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AUTOMATIC WATER CONTROL SYSTEM

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Abstract: By taking into account the water pump problem that ICFAI University is currently facing. The water supply system at ICFAI University is currently experiencing significant inefficiency. The primary issue is that, because all of the water tanks are connected to one another, when one of them fills up, the water pump continues to run. Since there is only one water pump, it is unethical to turn it off, which causes the already-full tanks to overflow. Therefore, it is a total waste of precious resources. We have developed a solution to this problem that will save electricity in addition to water. We designed this system with the sole purpose of maximizing efficiency in mind. We implement this system using a microcontroller and a few smart sensors. To regulate the water flow, we utilize a different electronic valve for each tank. These valves are made to automatically close and open using a microcontroller's output. The way this system works is that each tank has sensors installed to detect when it is full. The sensors then send the microcontroller the input data, which indicates that the tank is full. The microcontroller then sends an output signal to the electronic valve to close the sensor-associated tank valve. This system works by filling the other tanks when one tank is full. If all the tanks are full, the microcontroller will receive all the sensor readings and will instruct the water pump to shut off automatically, saving a significant amount of energy. In conclusion, this system will use a lot of energy and resources, resulting in the highest possible efficiency.

Keywords: Inefficiency, Electronic valve, Microcontroller

I. INTRODUCTION

From urban water supply systems to agricultural irrigation, automatic water control systems enable the management and control of water flow and utilization in a range of contexts. These systems are designed to automatically monitor and adjust water usage to provide efficient and effective water management that reduces waste and improves water conservation efforts. This essay will examine the many kinds of automatic water control systems, their advantages, and how they are used in various contexts and industries. Water is extremely valuable to living things, yet its availability is steadily declining. This issue affects the majority of the nation's and the world's cities. This concern is one of the driving forces behind the ongoing efforts and the implementation of strategies to conserve water and benefit the environment, both of which contribute to the future availability of water. Therefore, conserving water is crucial. Many homes waste water needlessly due to storage tank overflows and other factors. This issue can be resolved with an automatic water control system. The sensor will detect changes in the water level and notify the water pump accordingly. The water pump motor is turned on or off based on these signals.

One definition of a water control system is a system that provides information on the water in a body of water. We encounter numerous situations where determining the level or volume of water in a given area is necessary. Determining the water level may be necessary to prevent river overflow. Water level indicators can also be used to measure water levels in tanks to prevent water waste or to verify dam safety standards. Additionally, it can be utilized to maximize river flow to reduce floods when a certain amount of water is needed [1].

In every moment of our existence, water is necessary. The water level in the water storage tanks is rarely monitored. Therefore, creating a

control system to operate with little to no human intervention is necessary for automatic water controlling. The concept can be utilized implicitly to determine and regulate the water level in water storage tanks and stop waste [2].

Modern agriculture cannot function without automatic water control systems, especially in areas with limited water supplies or where farmers must maximize their water use. To increase agricultural productivity while decreasing water usage, these systems are made to monitor and regulate water distribution to crops. In this literature study, we will examine the various types of automatic water control systems and their applications in agriculture. We will also talk about these systems' advantages and disadvantages. Automatic Water Control System Types: 1. Drip Irrigation Systems: Drip irrigation systems are a kind of automated water management system that supplies water straight to plant roots [3].

These systems are made up of pipes and valves that use a number of tiny emitters to distribute water to each plant. Drip irrigation systems are especially advantageous in desert areas where water resources are limited and optimizing water consumption is essential due to the high cost of irrigation water. Drip irrigation methods can dramatically boost agricultural productivity while using less water, according to studies. For instance, compared to conventional flood irrigation techniques, drip irrigation systems enhanced tomato yield by 59% while using 47% less water, according to a study done in India [4].

Sprinkler Irrigation Systems: Using a network of sprinklers, sprinkler irrigation systems are another kind of autonomous water control system that supplies water to crops. These systems prove particularly beneficial for crops such as fruit trees and vegetables, which require frequent watering. Sprinkler irrigation systems demonstrate a boost in agricultural output while using less water compared to conventional flood irrigation techniques. An Iranian study [5] found that spray irrigation systems increased wheat output by 47% while using 38% less water than flood irrigation systems. Third. Automated Water Management Systems: These more sophisticated forms of automatic water control systems maximize water use by utilizing sensors and data processing. These systems use sensors to track weather, soil moisture, and other variables that impact water use. To guarantee that each plant receives the ideal quantity of water, the system modifies water distribution based on this data. Studies have demonstrated that automated water management systems enhance agricultural output while using less water compared to conventional irrigation techniques.

When compared to conventional drip irrigation techniques, an automated water management system boosted tomato yield by 35% while using 30% less water, according to a study done in Israel [6]. Automatic water control systems have the following advantages: 1. Enhanced agricultural output: When compared to conventional irrigation techniques, automatic water control systems have been demonstrated to enhance agricultural output. This is so that each plant receives the ideal quantity of water thanks to these devices that improve water supply. 2. Decreased Water Use: When compared to conventional irrigation techniques, automatic water control systems can drastically cut water use. This is because these systems minimize water waste from evaporation and runoff by delivering water straight to plant roots.

Third. Better Crop Quality: By guaranteeing that every plant receives the ideal quantity of water, automatic water control systems can enhance crop quality. Higher-quality crops with improved flavor, texture, and appearance may come from this. 4. Cost Savings: By using less water and producing more crops, automatic water control systems can help farmers save money.

Higher profitability and a more sustainable farming enterprise may follow from this. Automatic water control systems' limitations include: 1. Cost: Installing and maintaining automatic water control systems can be costly, especially for small-scale farmers. 2. Technical know-how is necessary for the installation and upkeep of automatic water control systems. For small-scale farmers who might lack the requisite resources or expertise, this could be a hurdle. Third. Power Source: A dependable

power source is necessary for automatic water control systems.

II. MATERIALS (HARDWARE AND SOFTWARE)

A. Water Pump

Operating from a 2.5–6V power source, this DC 3-6V Mini Micro Submersible Water Pump is an inexpensive, compact submersible pump motor. With a very low current usage of 220 mA, it can process up to 120 liters per hour. Simply plug the motor outlet into the tube pipe, immerse it in water, and turn it on. [7]. A small micro submersible pump is one type of water pump that can run on a low-voltage DC power source. It can pump water from one location to another and can be submerged in water. It can be utilized for several things, including aquariums, fountains, and irrigation.

B. Arduino UNO

One of Arduino's standard boards is the Arduino UNO. Additionally, it was Arduino's first USB board. It is regarded as a strong board that is employed in numerous projects. The Arduino UNO board was created by Arduino.cc [8]. One of Arduino's standard boards is the Arduino UNO. The ATmega328P microprocessor serves as its foundation. It features an ICSP header, a USB connector, a power jack, six analog pin inputs, and fourteen digital pins. An Integrated Development Environment (IDE) that supports the C and C++ programming languages can be used to program it. Numerous projects involving sensors, actuators, LEDs, motors, etc. can make use of it. Numerous shields and modules that can increase its capabilities are compatible with it.

The ATmega328P microprocessor serves as the foundation for the Arduino UNO. Compared to other boards, like the Arduino Mega board, etc., it is simple to use. The board is made up of shields, various circuits, and digital and analog input/output (I/O) pins. A brief pin description of Arduino UNO is illustrated in Fig. 1.

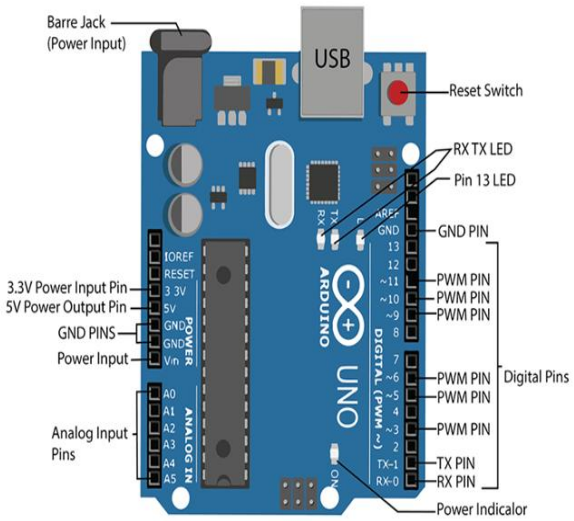

Figure 1. Pin description of Arduino UNO

C. Electronic Valve

An electric valve known as a solenoid valve opens or closes by means of an electromagnet. It is made up of a plunger, a coil, and the valve body. A magnetic field produced by an electric current flowing through the coil draws the plunger in and moves the valve [9]. When the current is stopped, a spring or gravity pulls the plunger back to its starting position, closing the valve.

An electronic expansion valve is a kind of electric valve that modifies its opening using a pulse-width modulation (PWM) signal or a stepper motor. In refrigeration systems, it regulates the flow of refrigerant into the evaporator. It is composed of a valve body, a motor, and a controller. To control the valve opening, the controller sends impulses to the motor after receiving input from sensors. The motor modifies the orifice size and rotates the valve stem [10].

Figure 2. Electronic Valve

An Electric Valve is illustrated in Fig. 2.

D. Arduino IDE

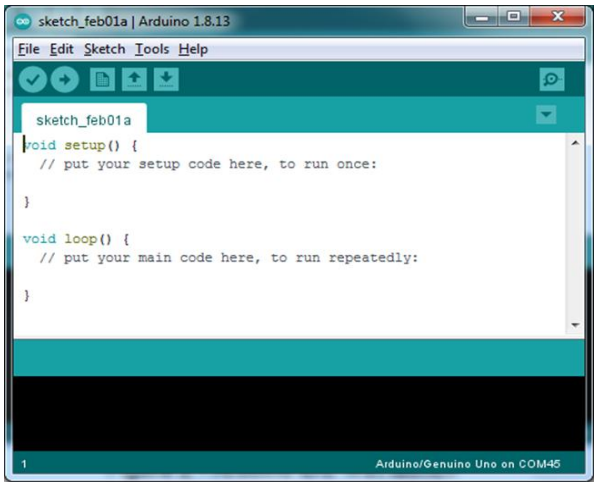

Figure 3. Arduino ide

The Arduino Integrated Development Environment (IDE) is a software application that allows users to write, compile, and upload code to Arduino microcontrollers [11]. Users can use cross-platform software on various operating systems such as Windows, macOS, and Linux. It is easy to use even for novices, and the integrated development environment (IDE) offers a straightforward interface for writing and editing code. An Arduino ide is illustrated in Fig. 3.

III. BLOCK DIAGRAM AND WORKING

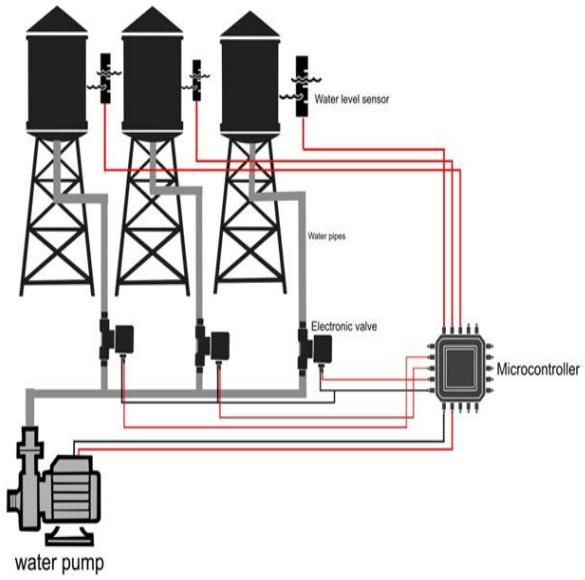

Fig. 4 Block Diagram [12]

This project is comprised of three water tanks, each of which is fitted with an electronic valve and a sensor that measures the water level. The electronic valve receives a signal from the water level sensor, which determines whether the tank is full or empty, and then opens or closes the valve in accordance with the detected level. Controlling the flow of water into or out of the tank is the responsibility of the electronic valve. A single water pump is also there, and it is responsible for drawing water and distributing it to the three tanks via a shared conduit. A Block Diagram is illustrated in Fig. 4

The following is an explanation of the project's operating principle: The electronic valve of each of the three tanks receives a signal from the water level sensor when any of them is empty. This signal causes the electronic valve to open, allowing water to enter from the common pipe [13].

* The water level sensor of each of the three tanks sends a signal to the electronic valve, causing it to close and halt the flow of water when any of the tanks reaches its maximum capacity. The microcontroller will take all three outputs and turn off the water pump when all three tanks are full. This is because there is no demand for water from the common line when all three tanks are full. As soon as any of the three tanks reaches the point where it is completely depleted, the electronic valve on that tank opens, so generating a demand for water from the shared pipe. This causes the microcontroller to transmit a signal that activates the water pump [14]. A Flow chart is illustrated in Fig. 5

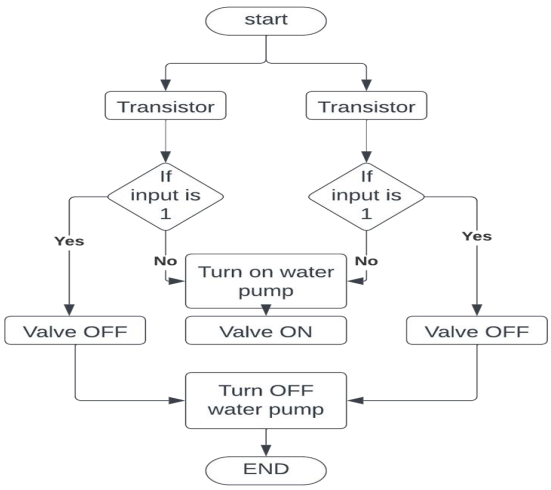

Fig. 5 Flow chart

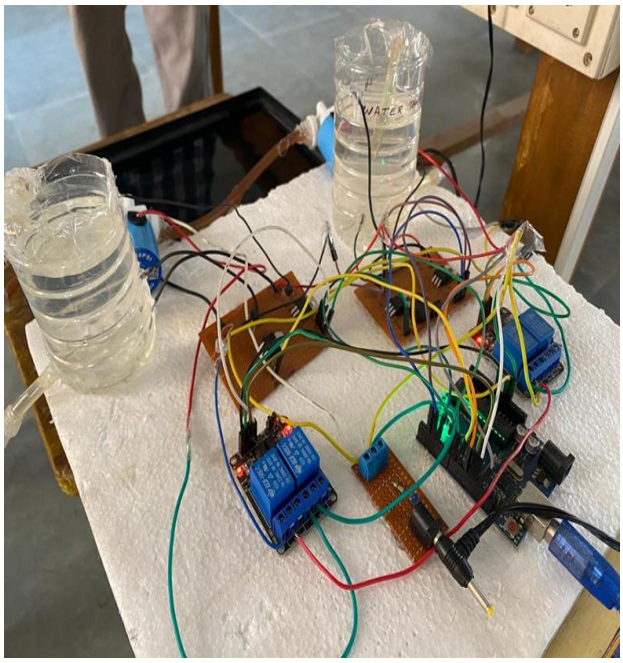

Fig. 6 Working model

These tools will be of great assistance. One of the primary functions of these devices is to regulate the flow of water. As soon as the water level in the tank drops below a particular threshold, it will automatically replenish the tank [15]. Additionally, when the water level drops below a specific threshold, it will immediately turn off the water flow in order to prevent the tank from overflowing. A Working model is illustrated in Fig. 6

By utilizing this equipment, it is possible to entirely eliminate the possibility of the tanks being filled to their maximum capacity. It is possible to avoid dry running by ensuring that the motor switch is turned off automatically when the subterranean tank is depleted. When it comes to water and electricity conservation, these devices are incredibly useful because they assist in saving both resources. The reason for those benefits is that the fundamental objective of these devices is to provide control over the water supply and, as a result, minimize the amount of energy that is consumed. The use of these devices is especially beneficial during periods in which the saving of energy is a top priority. These devices also help you save money on your expenses [16].

Due to the fact that these systems streamline the utilization of water flow, they conserve not only water but also energy, which leads to a reduction in waste and an increase in savings. In the long term, they will assist you in saving a significant amount of money. One of the benefits that these computers typically possess is that they are self-contained. This reduces the amount of frustration that is connected with controlling things like a water tank, as well as the amount of effort that is required to maintain the appropriate water levels.

These devices, equipped with timer switches, eliminate the need for physical labor. It is also possible for these automated devices to prohibit water from running at inconvenient times. The timer switches make it easier to control the water flow in the tank. Furthermore, these devices maintain the water level without any physical control. The most impressive aspect of these devices is the way in which they make effective use of water [17].

We require a greater quantity of water throughout the day than we do late at night. The controller regulates the water supply in accordance with its requirements, so minimizing the risk of overflow or underflow and maximizing the effectiveness of water use. Additionally, the regulator ensures that the appropriate quantity of water is always accessible at all times.

IV. CONCLUSION AND FUTURE SCOPE

In various contexts, the utilization of water can be managed and controlled through the implementation of a technology known as an automatic water control system. This approach is especially advantageous in circumstances in which water needs to be conserved or if there is a substantial amount of water waste that needs to be decreased.

The installation of an autonomous water control system has the potential to bring about a multitude of advantages, such as increased water efficiency, less water waste, and decreased water expenditures. Additionally, it can assist in reducing the likelihood of water damage, leaks, and other problems that are associated with water.

In general, an autonomous water control system is an efficient method for managing water consumption and conserving this vital resource to a significant degree. Through the implementation of such a system, individuals and organizations have the opportunity to take a big step toward achieving sustainability and environmental responsibility goals. A complex technology known as an

automatic water control system permits the automatic management of water supply and distribution in a variety of applications. The system utilizes monitoring and control equipment to monitor and control the water flow, pressure, and level. Due to the growing shortage of water and the imperative to maximize water utilization, the Automatic Water Control System has garnered a lot of attention as an effective option for water management. The purpose of this article is to investigate the potential advantages of the Automatic Water Control System as well as its prospective usage in various industries in the future.

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