Automated Control Sensor-Based Water Storage Purifying System with Help of Chemical and Filters

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***Abstract* - Our health is at risk due to widespread water pollution or declining water quality. More harmful than any known infection is unsafe water. As the country grows and becomes more urbanized, both deliberate and inadvertent actions by the general public are poisoning India's water sources. This is where our concept, which will satisfy individual needs regarding water quality, comes in. Because water is gathered from a shared storage system (such as a pond, river, and communal water tanks) and then delivered to large complexes (such as housing societies, apartments, etc.). We saw the necessity for a model that would mainly filter water so that it could be utilized for domestic tasks without the risk of consuming poisonous water. It would also extend the lifespan of various water-using electrical devices, such as washing machines and water purifiers. In this project, we utilized a pH sensor to identify undesirable particles, an Arduino UNO to control the hardware based on the software's parameters, a solenoid valve to regulate the chemical flow, and a relay to keep everything running smoothly. Hence our idea would check the chemical health of water and will purify it primarily before supplying it to the households.**

Keywords – *Degrading water health, Water storage purification, pH sensor, Chemical blast.*

1. INTRODUCTION

The water quality has gotten worse recently. This industry releases almost 80% of its wastewater into the environment without proper treatment, eventually contaminating rivers, lakes, and seas. Our fitness is being deteriorated by this widespread water contamination. Viruses are not nearly as deadly as polluted water. Numerous water purifiers have been developed for this purpose and are currently available on the market. Filtration is necessary to prevent several forms of adulteration in the 1% of freshwater that we use for drinking and various domestic tasks. Every time we install a water purifier or other electronic gadget that uses water to do household tasks, the installer frequently informs us that the water we receive is of poor quality and could interfere with the machine's operation or cause damage before it is anticipated to. Our home's water supply can be a big problem. Although the high mineral content of hard water may not be harmful to our health, it has a significant effect on our skin and hair. Some of the water we use for bathing may be rough. One of the first signs of using low-quality water is having thin hair, dry skin, and brittle nails. Other effects on hair that we frequently ignore include thinning, color-treated hair fading more quickly, difficulty creating lather when shampooing, and—most importantly—hair loss, which many people experience. On the other hand, dryness is a noticeable effect on skin, similar to hair, where hard water makes it difficult to remove soap from the skin's surface, causing irritation and, in extreme situations, allergies. People with sensitive skin may develop psoriasis and eczema. This is where our idea comes in. We plan to suggest an affordable automated sensor-based water tank purifier that will be connected to the main water tank or the water supply of large complexes (apartments, housing societies, etc.). It will remove all impurities and then supply the water to various households. This one idea will replace the numerous external water purifiers in the washing machines, and it will also make it easier for the water purifier to filter the water, resulting in better and purer water for us to drink. If the proper use of our concept is promoted, this one investment will prove to be highly cost-effective in the long term. If properly applied, it would also be much better for our skin, hair, and general health.

2. LITERATURE REVIEW AND GAP RECOGNITION

2.1. Review study

To detect oil spills from water, Y. Sanuki et al. employed sensors and polarization analysis techniques. They measured the water's temperature and turbidity using a TB-50 integrated spherical turbidimeter. The minimum detectable oil thickness for heavy oil was 0.05 mm, according to sensitivity testing of the sensor system utilizing raw water. Additionally, using the turbidity standard solution in 2002, they discovered that the sensor could detect a thickness of 0.05 μm under turbidity up to

100 mg/L [1]. A novel sensor created by Giovanni Pavanello et al. responds to biofilm formation more quickly and precisely. They essentially operate in two stages: first, they examine how the sensors react to the growth of biofilms; second, they use the data to perform a chemical treatment procedure in the pipeline.In 2010, the project produced an effective biofilm monitoring system [2]. In 2015, Karan Kansara et al. created a sensor-based automated system that sends a signal to a microcontroller in response to changes in ambient temperature and humidity [3]. In the next year, Eka Chaya Parima et al. developed a concept that was primarily centered on using an Arduino sensor-based system to control an overflow system, an automated irrigation system, and a plant watering system [4]. In 2017, Farmanullah Jan developed an IoT- and AI-based smart water tank that aids in regulating water leaks, monitoring water levels, and managing motors [5]. The HC-SR04 ultrasonic sensor, turbidity sensor, and pH sensor are components of a system constructed by Nikhil Kawade et al. that are used to measure the water level, determine the turbidity of drinking water based on the amount of transmitted mild, and measure the pHIn the same year, they additionally incorporate a SIM900 GSM module and an Arduino Mega 2560 to send the sensed data to the recipient [6]. Sergey Staroletov created and put into use a specification-based assessment and automated method that same year [7].In order to improve sustainability, resilience, and livability, Yiheng Chen developed a water monitoring system based on ICT, "Big Data," and IoT. In order to improve system efficiency in the upcoming year, it also incorporates a wireless sensor [8]. Bhupesh B. Lonkar et al. developed a smart automatic control and water purification system using a wireless sensor system. The model was created so that it may be used with wireless sensors. It gauges the water's purity. Temperature, turbidity, pH, and ultrasonic sensors make up the model. A microcontroller is another component of the system that receives input from the sensors and executes actions. The turbidity sensor measures the amount of light that enters the water sample. The amount of water is actually determined by the ultrasonic sensor, which detects the water level. For certain items, such as small or distant objects, the ultrasonic sensor has limitations. In the same year, the temperature sensor measures the water's temperature [9]. To save rainwater for drinking purposes, STMLD Senevirathna et al. employ a fully automated and sustainable process. Over the past year, a variety of treatment procedures have been carried out, including UV disinfection, sand filtration, GAC adsorption, and aeration [10]. IoT technology was employed by Fahim Redwan et al. to view the water quality. For this procedure, they employed solar electricity. This system uses sensors to measure turbidity and pH. The records were sent to the cloud server via the Wi-Fi module. This system's circuit is well-designed to regulate the water pump, preventing energy and water waste. Actually, it can regulate the water flow according to the water level and a few other important water parameters. The microprocessor and several sensors that are needed to gather information and manage the pump are powered by the solar cell. Additionally, it provides continuous data and outcomes more quickly and regulates the pump appropriately within the same year [11 M. Reza Hidayat et al. created a water level monitoring device using the HC-SR04 ultrasonic sensor, which is entirely based on the AT Mega 328 microcontroller. The AT Mega 328 is a controller that functions as a statistics processor and shows all of the observed water level data at the gentle water tanks for a period of 12 months [12]. The HC-SR04 sensor is utilized here as a water level detector in the water tank. The sensors were employed by Ms. P. Rajalakshmi et al. to create a monitoring system for a gas purification facility (GCP). It shows both the volume and the location of the water within the tank. The water level in the tank is continuously tracked by the dispensed control system (DCS), which also maintains the variable at a set cost in response to various loads and variations during the operation. In the upcoming year, it will also be useful for machine layout and analysis under various load situations, as well as for comprehensive statistics in human-device interfaces (HMI) [13]. Mohammed Sadegh Sadeghi Garmaroodi et al. mine the records of the Christ osmotron water purifying system while using IoT to identify irregularities in the organization. Here, six sensors were used to help collect records over the roughly two-week intervals before and after system renovation. This gave us both the right and improper operational patterns based on information mining and machine learning (ML) in the same year [14]. Using ICT technology, Park developed the concept of a river or pond as enormous amounts of water that same year [15]. An electrochemical sensor was employed by Xian Fangab et al. to detect trichloroacetamide (TCAM) in drinking water. The sensor exhibits great specificity for the presence of disinfection byproducts (DBPs) in the upcoming year, sensing ranges of 0.5−10 μM and 10−80 μM, and a detection restriction of 0.17 μM [16In order to filter water, E. Mendoza et al. employed sensors. According to this study, prototype implementation and testing were conducted using the C or C++ language on an 8-bit microcontroller, and the ATmega2560 microcontroller with a smart sensor also used the C or C++ language in the same year [17]. S. Staroletov purified and standardized water using an automation-based control software package. The usage of control-based discrete software for a water purification hardware device was covered in this paper. In fact, they have developed software that guarantees the production of purified water and also tracks water use and the efficiency of the appliances that are connected to it (e.g., dishwashers and washing machines). A chiller, a still, a

small and large water tank, digital devices, I/O devices, valves, and other components make up this system. To translate analog sensor values into the digital shape, they employed interpolation techniques. The procedure is time-consuming, as the temperature of the water and air varies significantly within the same year [18]. Mohammed Alshehri et al. treat desalinated water using the cloud and the Internet of Things. It offers the most effective method for the process of water distillation. In the same year, it includes smart technology, including solar-powered sensors, network connections, and cloud portals [19]. Water quality was monitored by Víctor Garrido-Momparlera et al. using cloud services, IoT, and smart sensors. An enormous amount of information is provided by smart sensors. creation of intelligent sensors to address ongoing in-line water quality monitoring. It also makes use of chemical sensors in the following year [20]. An IoT and machine learning-based Smart Water Purifier (SWP) system for individualized hydration and water conservation is presented by Thanh-Long Le, Thi-Hong-Nhi Vuong, Tran-Hanh Phung, Ngo Nhat Anh, Nguyen Viet Phong, and Pham Manh Truong [21]. Long-standing issues with existing water purifiers are addressed by Ajitesh Kumar and Mona Kumari, who offer innovative methods such as flow monitoring, water level parameter adjustment, and dynamic regulation using smart controllers. [22]. By implementing modifications to reverse osmosis purifiers, such as intelligent TDS adjustment and AI-based filter life prediction, M. Vishaal Dharsan, M. Vishnu, S. Surya Pravesh, and S. Kaliappan make user jobs easier and guarantee lower maintenance. [23].

2.2 *Gap Identification*

While our concept is mostly about water purification and filtration, Y. Sanuki's 2002 work primarily focuses on the temperature and turbidity of water. Additionally, Giovanni Pavanello's primary usage in 2010 was to remove biofilm buildup from pipelines, but our concept primarily involves water purification and filtration.

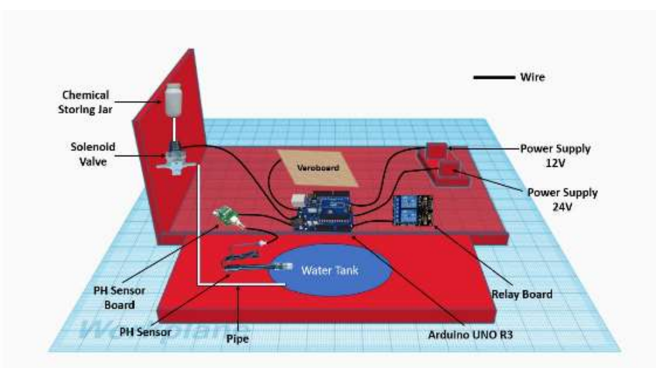
Karan Kansara concentrated on sensor-assisted automated irrigation systems in 2015, but our objective is to employ sensors to create automated water purification. The following year, Eka CahyaPrimaa concentrated on using sensors to regulate water overflow and automate irrigation systems, but in line with our concept, we employed sensors to concentrate on the purifying process. Farmanullah Jan used IoT (Internet of Things) for monitoring and control in 2017. However, we think we can utilize IoT for purification using various sensors (such as pH and ultrasonic) for a variety of domestic uses. All of the requirements for our idea are met in the same year by Nikhil Kawade; the only difference is that we must use this idea in an urban setting. Yiheng Chen, the following year, his primary goal is to assess the water's physical and chemical condition, but we also hope to cleanse it. In the same year, Bhupesh B. Lonkar concentrated on detection (temperature, turbidity, pH, and ultrasonic). These are the detections that are most important to our concept, but we also concentrated on the purification aspect of it. STMLD Senevirathna concentrated on purifying rainwater for drinking the following year, but our primary goal is not drinking; rather, we aim for the bare minimum of purification. in order for us to utilize it for domestic tasks.Fahim Redwan used the Internet of Things (IoT) concept for monitoring and control. It is not intended to detect all types of water pollutants, but our plan is to identify the pollutants in the water and then use a sensor to purify it in the same year based on the water's quality. STMLD Senevirathna concentrated on purifying rainwater for drinking the following year, but our primary goal is not drinking; rather, we aim for the bare minimum of purification. in order for us to utilize it for domestic tasks.Fahim Redwan used the Internet of Things (IoT) concept for monitoring and control. It is not intended to detect all types of water pollutants, but our plan is to identify the pollutants in the water and then use a sensor to purify it in the same year based on the water's qualityThe following year, it was discovered that although we could identify dangerous molecules in water using trichloroacetamide (TCAM), we were unable to cleanse it. For the purpose of filtration, E. Mendoza employed smart sensors. However, it is not stated which purification reagent was employed, and based on our theory, we concentrated primarily on purification that year. The system is too similar to our concept, S. Staroletov. However, since it is effectively purifying the water so that we can use it for drinking as well, it will demonstrate the model's drawback, which is that the water purifier becomes unwanted at that point. Our primary goal is to use sensors (pH and ultrasonic) to purify the water as little as possible in the same year.

When Victor Garrido-Momparlera returned the following year, Miguel Peris concentrated on monitoring, but cleansing was also necessary based on our demands. A thorough review of smart water purifiers that integrate IoT and machine learning for individualized hydration and water conservation is presented by Thanh-Long Le, Thi-Hong-Nhi Vuong, Tran-Hanh Phung, Ngo Nhat Anh, Nguyen Viet Phong, and Pham Manh Truong in the upcoming year. Although the distinctive features include data-driven purification procedures and user behavior tracking, the primary emphasis is on user-centric benefits rather than technical or infrastructure-related concerns. In the same year, Ajitesh Kumar and Mona Kumari describe ways to address frequent issues with contemporary water purifiers, such as dynamic control through smart regulators, adjustable water level parameters, and water flow monitoringAlthough this focuses on user convenience and resource efficiency, it primarily relies on human inputs and doesn't give any thought to autonomous selfoptimizations. Next year, M. Vishaal Dharsan, M. Vishnu, S. Surya Pravesh, and S. Kaliappan will introduce advances in RO purifiers that will improve user convenience and maintenance efficiency. These innovations include smart TDS adjustment and AI-based filter lifespan prediction. However, it focuses mostly on household consumption, with little attention paid to environmental effects or comprehensive real-time water quality control.

3. METHODOLOGICAL LAYOUT

Block Diagram, Blueprint and Proteus simulation

Water enters the system straight from the tank to start the process. A solenoid valve is operated by a relay-driven mechanism that regulates the flow according to input parameters that are analyzed by the Arduino Uno. A sensor array in the system tracks pH levels and sends real-time signals to the microcontroller for analysis. Through the relay driver circuit, the Arduino Uno decodes these signals and starts specific actions. The relay activates to open the solenoid valve, enabling the water to flow through unchanged if the water quality is within the permissible threshold range. The relay initiates a chemical blast mechanism through a calibrated pumping system inside the tank when the water falls outside of permitted bounds. In order to precisely control the water flow and channel treated water to its destination, the solenoid valve stays in sync with the relay. The relay ensures smooth operation and quick switching in a variety of scenarios, and the



system architecture is built for autonomous operation. Relay action is guaranteed to continue uninterrupted by a continuous power supply, preserving great operational precision and reliability.

Fig 1. Blueprint for Automated Water Purification System

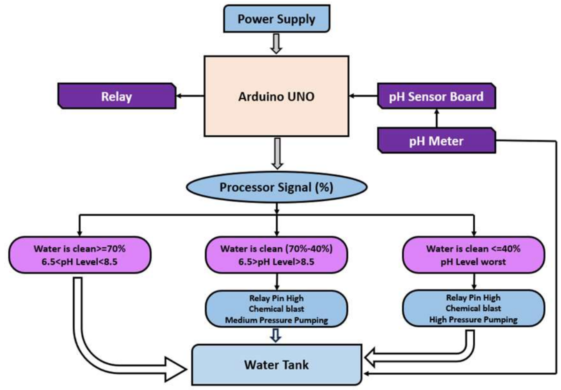


Fig 2. Block Diagram for Automated Water Purification System.

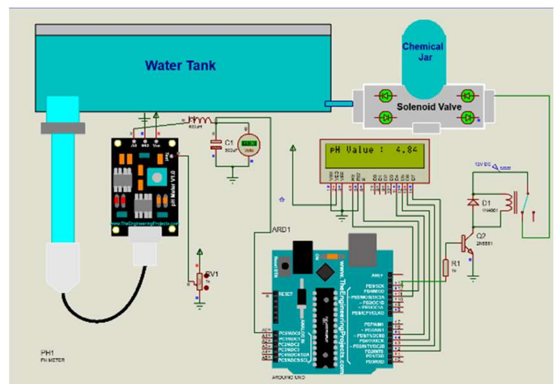


Fig 3. Proteus Simulation Output for Automated Water Purification System.

4. Working Model and Output -

Our system was rigorously tested using a combination of acidic and basic substances, where baking soda was used as the base and vinegar as the acid. Furthermore, we experimented with water samples from different regions to evaluate their pH values and associated impacts on the relay state.

pH Value	Voltage	Measure Value	Relay Status
4.12	3.02	597.8	ON
4.78	2.09	637.8	ON
5.22	2.17	662.5	ON
6.18	2.34	716.4	OFF
7.89	2.66	812.4	OFF
8.89	2.84	868.6	ON
9.00	2.86	874.8	ON

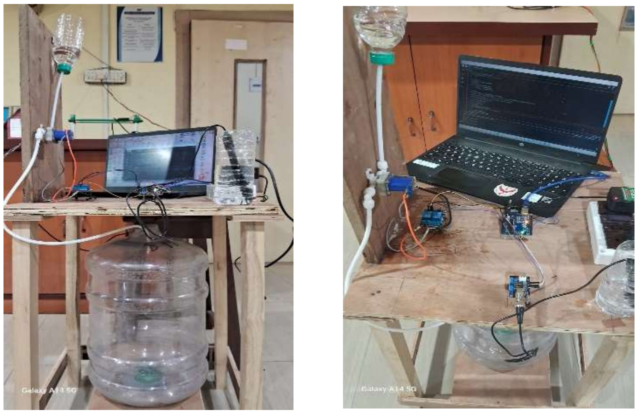


Fig 4: Running Working Model

The pH of the water sample determines how the system functions. Water is categorized as acidic when its pH is less than 6, at which point the relay state is activated (ON) to initiate the required processes. The water is regarded as neutral to slightly basic if the pH is between 6 and 8, and the relay state stays deactivated (OFF). The relay state also stays in the OFF position when the pH is higher than 8, which indicates extremely basic water.

This logic provides a strong and flexible reaction to changing chemical environments by precisely classifying and controlling the relay according to pH levels.

5. Conclusion and Future work–

In order to prevent the water from affecting the filtration equipment, we explained in this work how to perform basic water purification. This device for simple water purification is made using an Arduino UNO, Ph-Meter, solenoid valve, and relay. However, there are certain disadvantages, such as the fact that we haven't built a sedimentation filter to remove small impurities and we don't work on cost efficiency.

Therefore, we might suggest adding the sedimentation filter and lowering its cost in our upcoming work.

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