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Automatic Water Dispenser Machine

[1]Sahabi Ansari, [2]Danish Ali Hashmi, [3]Iqra Khan, [4]Anamika Agrawal, [5]Prof. Satyarth Tiwari
[1,2,3,4]*Student, Department of Electronics & Communication Engineering, LNCTE, Bhopal, India*
[5]*Guide, Department of Electronics & Communication Engineering, LNCTE, Bhopal, India*

***Abstract*— The Automatic Water Dispenser Machine is a hygienic and efficient solution designed to dispense water or other liquids without physical contact. In the wake of increased awareness around cleanliness and disease prevention, this project aims to minimize the risk of contamination by incorporating a touchless dispensing mechanism. The system employs an ultrasonic sensor to detect the proximity of a user's hand, triggering a servo motor to release the liquid. Controlled via an Arduino Uno, the setup ensures accurate distance measurement and timely activation of the servo for smooth operation. Powered optimally using a 7.4V battery, the device is energy-efficient and adaptable for use in public places such as offices, hospitals, schools, and homes. Its versatility in dispensing various liquids further enhances its practicality. By promoting hygiene, conserving resources, and encouraging automation, this project contributes meaningfully to the development of smarter and safer environments.**

***Keywords*—Water, Dispenser, Battery, Machine.**

I. INTRODUCTION

The Automatic Water Dispenser Machine is a touchless system designed to promote hygiene and efficiency in water dispensing, especially in public or shared environments. By using an ultrasonic sensor to detect hand presence, this system eliminates the need for physical contact, reducing the spread of germs and ensuring a cleaner, safer user experience. Manual water dispensing systems can be inefficient and unhygienic, particularly in situations where multiple users access the same container. Touchless dispensing addresses these concerns by using proximity sensing to activate water flow automatically. This is particularly beneficial in hospitals, schools, public places, or even households looking for smarter solutions. The heart of the system is the Arduino Uno microcontroller, which receives input from the ultrasonic sensor. When a hand is detected within a specific range, the Arduino activates a servo motor that opens the water outlet, allowing water to flow from the container. Once the hand is removed, the motor returns to its original position, closing the outlet. The ultrasonic sensor plays a key role in detecting the presence of an object (in this case, a hand) within its range. It sends high-frequency sound waves and measures the time taken for the echo to return, calculating the distance. When the measured distance falls below a predefined threshold, it triggers the dispensing mechanism. The servo motor acts as the actuator that controls the opening and closing of the water outlet. It receives signals from the Arduino and precisely adjusts its angle to either allow or stop water flow. The motor operates on a 5V input, making it compatible with Arduino's output and efficient in its operation. This system is powered by a 7.4V lithium-ion battery, which is ideal for delivering stable voltage and supporting the functioning of both the Arduino and the motor. It ensures portability and reliable performance without the need for direct electrical connections, making the dispenser suitable for both indoor and outdoor usage.

II. LITERATURE SURVEY

The evolution of automatic dispensing systems has gained significant attention in recent years, especially due to the heightened emphasis on hygiene, particularly after the global COVID 19 pandemic. The application of ultrasonic sensors in automation projects has also been extensively studied. These sensors emit ultrasonic waves and measure the time it takes for the echo to return after bouncing off an object. Their high accuracy, immunity to environmental noise, and ability to work in both well-lit and dark environments make them superior to many other sensing technologies. A range of experimental models has been tested using ultrasonic sensors for liquid level detection, obstacle avoidance in robotics, and even automated lighting systems. These experiments confirm the reliability of ultrasonic sensors in real-time, short-range detection, which is crucial in a water dispensing system where accurate hand detection is necessary to avoid water wastage and ensure timely activation. The servo motor, another key component in this project, has been explored in various applications for its precise angular control and low-power requirements. Literature suggests that servo motors are highly efficient for tasks requiring limited rotation, such as opening a

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valve, pressing a button, or tilting a panel. In automatic systems, the integration of servo motors with Arduino is well-documented, with numerous examples demonstrating how pulse-width modulation (PWM) signals can be used to control the angular position of the motor. Academic studies and DIY projects alike have confirmed that standard servo motors can operate reliably within the 5V output range of Arduino boards, making them a preferred choice for lightweight, responsive tasks like water valve control in dispenser systems. In summary, the existing body of research and practical experimentation in the domain of touchless dispensing mechanisms supports the development of the automatic water dispenser machine. It draws from proven technologies such as ultrasonic sensors for non-contact detection, Arduino Uno for intelligent control, and servo motors for mechanical actuation. This literature survey highlights the interdisciplinary nature of such projects, combining electronics, embedded systems, and hygiene-centered design. The growing trend toward automation, especially in health sensitive environments, makes this project not only relevant but also necessary. By building upon established findings and adapting them to a focused application, the proposed system provides a timely and effective solution that aligns with the ongoing push toward safer and smarter human interaction with everyday utilities.

III. WORKING

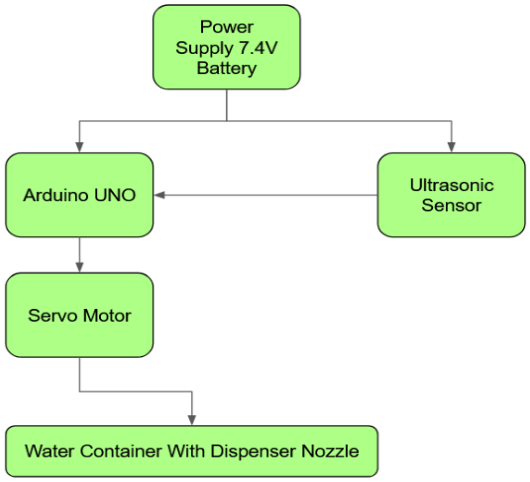

Figure 1: Block diagram

The block diagram illustrates the working components of the Automatic Water Dispenser Machine, highlighting the interconnection between the power source, sensing unit, control unit, and actuator. At the core of the system is the Arduino Uno microcontroller, which orchestrates the entire operation based on sensor inputs. The power supply is provided by a 7.4V lithium-ion battery, ensuring that the system can operate efficiently without external power. This battery is connected to the Arduino Uno via its VIN and GND pins, providing consistent power to all connected components including the servo motor and the ultrasonic sensor. The ultrasonic sensor is connected to the Arduino through digital pins (Trig to D10, Echo to D11) and powered using the 5V and GND lines. It continuously measures the distance to any object in front of it. When a hand is detected within the predefined range, it sends a signal to the Arduino, triggering the next stage of operation. Upon receiving the signal from the sensor, the Arduino activates the servo motor, which is connected to pin D9. The servo is responsible for opening and closing a valve or moving a flap to control the water flow from the container. It operates using the 5V power output from the Arduino and shares a common ground with all other components. Finally, the water container and dispenser nozzle complete the mechanical assembly. When the servo rotates, it either lifts or shifts the nozzle mechanism to allow water to pour out. As soon as the user's hand moves away, the ultrasonic sensor detects the increased distance, and the Arduino signals the servo to revert its position, stopping the water flow. The system ensures that there is no need for contact or touch when the action of dispensing takes place and it is more hygienic in practice rather than touching taps, especially during times of social distancing such as covid or other scenarios where there is risk of contamination and diseases.

The automatic water dispenser machine functions by using an ultrasonic sensor to detect the presence of an object (usually a hand) and a servo motor to control the release of liquid. The core of the system is the Arduino Uno, which reads the sensor data and sends instructions to the servo based on the calculated distance. The entire process is real-time and contactless, making the system both hygienic and efficient. When the system is powered on, the ultrasonic sensor continuously emits sound waves through its trigger pin. These waves bounce back when they hit an object, such as a hand placed in front of the dispenser. The echo pin receives the reflected waves, and the time taken for this round trip is measured by the Arduino. This time value is then converted into a distance using a predefined formula, allowing the system to detect how far the object is from the sensor. If the measured distance is less than a preset threshold (for example, 20 centimeters), the Arduino interprets this as the presence of a hand under the dispenser. It then sends a command to the

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servo motor to rotate to a certain angle, typically 90 degrees, which opens a small flap or outlet on the container. This action allows the liquid inside—water or sanitizer—to flow out. The servo motor remains in the dispensing position for a set amount of time, such as 7 seconds, which is long enough for a person to collect the liquid. After the delay, the Arduino sends another signal to the servo to return to its original position (usually 0 degrees), which closes the flap and stops the flow of liquid. This ensures the system does not waste water or continue dispensing after the hand is removed. Throughout the process, the Arduino runs a loop that keeps checking the sensor distance. This makes the system responsive and automatic without the need for any buttons or switches. The system resets itself after each dispensing cycle and becomes ready to detect the next hand, making it highly suitable for public places where frequent usage occurs. A key advantage of the setup is the use of a 7.4V lithium-ion battery, which provides stable power for both the Arduino and the servo motor. This ensures consistent performance and avoids voltage drops that could affect sensor accuracy or motor rotation. It also makes the system portable and easy to install in different locations without needing a direct AC power source.

Since hygiene is a major concern, especially in medical facilities, offices, or schools, this system eliminates the need for physical contact. The non-contact sensing mechanism significantly reduces the risk of cross-contamination, making it safer than traditional tap or pump-based dispensers. The use of an ultrasonic sensor also enhances durability since there are no mechanical parts exposed to the liquid. Overall, the working of the system is simple yet highly functional. It combines distance sensing, real-time processing, and mechanical actuation in a synchronized way. With minimal hardware and low power consumption, the automatic water dispenser delivers a practical solution for everyday hygiene and hands-free liquid access. The ultrasonic sensor plays a crucial role in ensuring the system only activates when truly needed. Its continuous pulse-based measurement approach ensures accuracy and eliminates false triggers caused by distant objects. This allows the system to conserve battery power and avoid unnecessary servo movements. The sensor's reliability and long-range detection (typically up to 400 cm) make it suitable for varying environmental conditions and usage scenarios, from indoor offices to outdoor kiosks. The servo motor, on the other hand, functions as the mechanical actuator that controls the flow of water or liquid. By precisely rotating to predefined angles, it opens and closes the valve or lever connected to the water container. Its smooth and quick operation enables an efficient dispense mechanism without spilling or delays. Since servo motors respond quickly to the Arduino's commands, the dispensing feels immediate and intuitive to the user, further enhancing the contactless experience. The Arduino Uno is programmed using C++ code to handle all control logic. It initializes the pins, reads values from the sensor, calculates the distance, and makes decisions based on thresholds. The loop function ensures that this cycle continues without interruption. Proper delays are added to prevent sensor overlap and to give enough time for the servo to move smoothly. All this combined makes the dispenser not only automated but also smart and user-friendly, capable of operating continuously without human intervention.

IV. Results

Automatic Water Dispenser Machine was successfully implemented and tested using an Arduino Uno, an ultrasonic sensor, and a servo motor. During testing, it was observed that the system accurately detected the presence of a hand within 20 cm and activated the servo motor to dispense water. The response time was quick, and the system performed consistently across multiple trials without manual interference, demonstrating its suitability for touchless operation. The ultrasonic sensor measured distance effectively with minimal error in stable lighting and environmental conditions. When a hand approached the sensor, the servo rotated precisely to 90 degrees, and after a delay of 7 seconds, it returned to 0 degrees. This mechanism ensured that water was dispensed for a limited time, promoting water conservation while maintaining hygiene standards. Multiple trials were conducted at different distances to check the reliability of the detection mechanism. The device only triggered the servo motor when an object was within the defined range, thereby reducing the chances of false triggers. It was also observed that the servo motor operated smoothly and returned to its default position without lag or jittering. The overall hardware performance was stable, and the system remained functional even after extended periods of use. The use of jumper wires allowed easy troubleshooting and replacement of components during testing. This made the prototype reliable and modular, with room for future upgrades like adding an LCD, buzzer, or a water level detector for enhanced functionality.

V. Conclusion

Automatic Water Dispenser Machine project achieved its objective of providing a hygienic, touchless solution for water dispensing. The integration of the ultrasonic sensor and servo motor with Arduino was effective in creating an automated system that promotes safe and efficient hand hygiene practices. The system is low-cost, easy to build, and scalable for larger applications such as hospitals, schools, and public places. Future enhancements could include solar power integration, more precise sensors, or IoT connectivity for

smarter monitoring. Overall, this project serves as a practical example of how automation and embedded systems can contribute to everyday health and hygiene.

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