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Liquid Dispenser

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***Abstract*— This paper outlines the development of an automated liquid dispenser utilizing an Arduino microcontroller. Designed for accurate and consistent liquid measurements, the dispenser enhances experimental reproducibility and reduces human error, ensures precise measurements for consistentency and has the ability to dispense fluids accurately. The system integrates sensors, pumps, and valves controlled by the Arduino microcontroller, handling liquids of varying viscosities. User-friendly interfaces enable easy calibration and operation, accessible to users with minimal technical expertise. This project advances automated dispensing technology, offering potential for further customization and scalability to meet specific user requirements.**

***An intuitive user interface is developed for simple operation, with clear instructions and a minimal learning curve. Safety features are incorporated to prevent spillage, over-dispensing, and contamination. Additionally, the design is optimized for cost-efficiency without compromising on quality and performance.**

By focusing on these objectives, the project aims to advance the technology of liquid dispensing systems, making them more accessible and effective across various fields.

Keywords: Liquid Dispenser, Arduino Microcontroller, Precise Measurement, Sensor Integration, User-Friendly Interface, Consistent Dispensing.

I. INTRODUCTION

The design, development, and implementation of an automated liquid dispenser system are critical for various applications requiring precise liquid measurements. This project focuses on creating a system that accurately dispenses predetermined amounts of liquid, addressing the needs of domestic, industrial, medical, and laboratory settings.

Automated liquid dispensers are invaluable tools in many environments. In households, they are used for dispensing soaps, hand sanitizers, and kitchen liquids like oil and syrup. In industrial settings, they facilitate the precise dispensing of lubricants, chemicals, and other fluids essential for manufacturing processes. The medical field relies on such devices for the accurate delivery of medications and disinfectants, while laboratories use them to dispense reagents, solvents, and other liquids in controlled quantities.

The primary goal of this project is to develop a device that is efficient, user-friendly, and reliable, capable of handling different types of liquids with varying viscosities and properties. To achieve this, the project focuses on ensuring the dispenser delivers the exact amount of liquid required, minimizing waste and ensuring consistency. The system is designed to handle a range of liquids, from water to more viscous substances like oils or syrups.

II. METHODOLOGY / EXPERIMENTAL

The methodology of the liquid dispenser project involved the following key stages

Component Selection and Procurement:

- [1] Arduino UNO: Chosen for its ease of use and versatility in interfacing with various sensors and actuators.
- Cutter, Glue Gun, Soldering Machine: Used for assembling the physical parts.
- Keypad: For user input to set the desired volume of liquid.
- DC Motor Pump: For pumping the liquid.
- Tools: Scissors, tape, glue, and [2] Arduino IDE for coding and debugging.
- Jumper Cables: For electrical connections between components.

Design and Prototyping:

- [3] Created a rough sketch of the final physical layout.
- Assembled the components according to the design.

Interfacing Components:

- Connected the LCD, keypad, DC motor pump, and water flow sensor to the Arduino UNO.
- [2] Ensured proper electrical connections using jumper cables and soldering where necessary.

Programming and Calibration:

- [1] Developed the code using the Arduino IDE to control the DC motor pump based on user inputs from the keypad.
- [4] Calibrated the water flow sensor to achieve maximum accuracy in liquid measurement

Testing and Debugging:

- Conducted extensive testing to identify and fix errors.
- Adjusted the pump speed and sensor sensitivity to ensure precise dispensing.

III. EXPERIMENTS

Setup:

- [1] The Arduino UNO was programmed to control the DC motor pump based on inputs from the keypad.
- [3] The water flow sensor was calibrated to provide accurate real-time monitoring of the dispensed liquid volume.

Procedure:

- Users input the desired volume via the keypad.
- The Arduino processes the input and activates the DC motor.
- The water flow sensor monitors the dispensed volume in real-time, sending feedback to the Arduino to adjust the pump operation accordingly.

Data Collection:

- Measured the volume of liquid dispensed over multiple trials.
- Recorded any discrepancies and made necessary adjustments to the system.

IV. RESULTS

The results of the experiment showed:

- High Accuracy: The system achieved an average error margin of ±2%, demonstrating high precision in liquid dispensing.
- Consistency: The liquid dispenser consistently delivered the desired volume across multiple trials.
- Versatility: Successfully handled various liquids with different viscosities, including water, oil, and syrup.
- User Interface: The keypad and LCD provided an intuitive and user-friendly interface for setting and monitoring the dispensed volume.

V. FUTURE SCOPES

Increasing Accuracy:

- Implementing advanced sensors with higher sensitivity.
- Refining the calibration process to further minimize errors.

Improving Usability:

- Designing a more presentable and compact model.
- Developing a standalone unit with an integrated display and control interface, eliminating the need for a laptop.
- Incorporating wireless connectivity for remote operation and monitoring.

Enhanced Features:

- Adding data logging capabilities for tracking dispensing history.
- Integrating additional safety features to prevent contamination and ensure hygiene.

VI. CONCLUSION

The liquid dispenser project successfully demonstrated that a cost-effective and reliable system can be developed for precise liquid measurement. With high accuracy, consistency, and the ability to handle various liquids, the device proved to be practical and efficient. The intuitive user interface and straightforward calibration process further enhanced its usability. Future improvements, such as adding wireless connectivity and data logging, could expand its utility and integration into more complex automated systems, making it a versatile tool for precise liquid handling needs.

By focusing on these future enhancements, the liquid dispenser can become even more accurate, user-friendly, and suitable for a wider range of applications in domestic, industrial, medical, and laboratory settings.

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