Science Lab Investigation: Creating a Digital Showerhead Aerator using an Arduino Microcontroller

Introduction: Welcome to your science lab investigation! Today, you will learn how to create your own digital showerhead aerator. This project will help you understand how technology can be used to save water and energy. Let's get started!

Objectives: By the end of this investigation, you will:

- Understand the importance of water conservation.
- Learn the basic principles of aeration.
- Construct a digital showerhead aerator.
- Test and analyze the efficiency of your aerator.

Materials Needed

- 1 standard showerhead (from kit)
- 1 small water pump (submersible)
- 1 Arduino microcontroller
- 1 flow sensor
- 1 LCD display
- Wires and connectors
- A small plastic or metal mesh
- Hot glue gun
- Scissors
- Screwdriver
- Water source (like a sink)

Step-by-Step Instructions

Step 1: Understand Aeration: Aeration is the process of mixing air with water. In a showerhead, this helps to reduce the amount of water used while still providing a strong flow.

Step 2: Prepare the Showerhead

1. **Remove the Showerhead**: Use a screwdriver to carefully remove the showerhead from its base.
2. **Insert the Mesh**: Cut a small piece of mesh to fit inside the showerhead. This will help mix air with the water.

Step 3: Set Up the Arduino

3. **Connect the Flow Sensor**: Attach the flow sensor to the water inlet of the showerhead. This will measure how much water is flowing through.
4. **Wire the Arduino**: Connect the flow sensor to the Arduino using wires and connectors.
5. **Attach the LCD Display**: Connect the LCD display to the Arduino. This will show the water flow rate.

Step 4: Program the Arduino

6. **Write the Code**: Write a simple program to read data from the flow sensor and display it on the LCD screen. You can find sample codes online or use the one below:

#include <LiquidCrystal.h> LiquidCrystal lcd(12, 11, 5, 4, 3, 2); void setup() { lcd.begin(16, 2); lcd.print("Flow Rate:"); } void loop() { int flowRate = analogRead(A0); // Assuming flow sensor is connected to A0 lcd.setCursor(0, 1); lcd.print(flowRate); delay(1000); }

7. **Upload the Code**: Upload your program to the Arduino using a USB cable.

Step 5: Assemble the Aerator

8. **Insert the Pump**: Place the small water pump inside the showerhead. This will help to push water through the mesh.
9. **Connect the Pump**: Attach the pump to the Arduino to control its operation.

10. **Seal the Showerhead**: Use a hot glue gun to seal any openings in the showerhead to prevent leaks.

Step 6: Test Your Aerator

11. **Connect to Water Source**: Attach your showerhead aerator to a water source like a sink.
12. **Turn On the Pump**: Use the Arduino to control the pump and start the water flow.
13. **Monitor the Flow Rate**: Observe the flow rate displayed on the LCD screen. Adjust the pump speed if necessary.

Step 7: Analyze and Record Results

14. **Measure Water Usage**: Compare the amount of water used with and without the aerator.
15. **Record Observations**: Note any differences in water pressure and flow rate.
16. **Draw Conclusions**: Based on your observations, conclude how effective your digital showerhead aerator is in conserving water.

Conclusion

Congratulations! You have successfully created your own digital showerhead aerator. Through this project, you have learned about water conservation, aeration, and basic programming with Arduino. Keep experimenting and exploring new ways to use technology to solve everyday problems!

Questions for Further Investigation

- How does changing the mesh size affect water flow and aeration?
- What other household devices could benefit from similar water-saving technology?
- How can you improve the efficiency of your digital showerhead aerator?

Remember, always ask for help if you need it and have fun experimenting!