

Voice Based Water Dispenser

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ABSTRACT

In today's world, automation and smart systems are becoming an important part of our daily lives. This project focuses on building a voice-controlled water dispenser that can provide hot, cold, or normal water based on the user's voice commands. The main aim is to create a hands-free, hygienic, and user-friendly water dispensing system using basic electronics and IoT concepts. The core of the project is the Arduino Uno, which acts as the main controller. A Bluetooth module (HC-05) is used to receive voice commands from a smartphone app. Once a command is received, the Arduino processes it and activates the respective relay, which then turns on the correct water pump—either for normal, hot, or cold water. To display the system status and selected water type, a 16x2 LCD screen is also included in the setup. To heat the water, we use a heating coil or heating element, which is connected through a relay for controlled operation. For cold water, we use a Peltier cooling module, which becomes cold on one side when power is supplied and is commonly used in small refrigeration systems. Each of these components is powered by an external DC source to handle the power requirements of the heater, cooler, and pumps. This project is especially useful in places where hygiene is a concern, such as hospitals, schools, homes, and public areas, as it reduces the need to physically touch buttons or levers. The system can be further improved by adding sensors for temperature or water quality in the future. Overall, this project demonstrates a practical application of embedded systems and IoT in everyday life, making common tasks smarter and more efficient.

Keywords: Automation, Water Dispenser, Voice Command

INTRODUCTION

The voice-activated water dispenser is a smart embedded system designed to dispense hot, cold, and normal water based on simple spoken commands. The project uses a Bluetooth module to capture voice inputs such as —hot water, —cold water, and —normal water, which are then processed by the microcontroller. According to the recognized command, the system triggers the corresponding relay to control the required outlet. A heating element is incorporated to supply hot water, while an LCD display provides real-time information about the selected mode and system status. Once a valid voice command is detected, the system activates the respective relay and dispenses the selected type of water for a fixed duration of 3 seconds, with an adaptor supplying safe and stable power to the circuit. This project demonstrates how electronics and automation can simplify everyday tasks by reducing manual operation. Voice control makes the device more convenient for users of all ages, particularly when a quick selection of water type is needed. The integration of microcontroller logic, relays, and Bluetooth communication shows how different components can work together to create an efficient and responsive system. Beyond convenience, the project also reflects the growing relevance of smart devices in modern homes, workplaces, and public areas.



Figure 1: Water Dispenser

Additionally, this voice-based dispenser offers a cost-effective approach to automation. Instead of using advanced or expensive technologies, the system relies on easily available components that are simple to program and maintain. This makes the design suitable for academic projects, small-scale implementations, and further enhancements such as IoT connectivity, temperature monitoring, or mobile app control. Overall, the project provides a practical example of how embedded systems and user-friendly interfaces can transform ordinary appliances into intelligent solutions.

LITERATURE SURVEY

- Sharma and R. Verma (2022) – Smart Voice-Controlled Home Automation System using Arduino and Bluetooth

This project introduces a home automation system that allows users to control various household electrical devices such as lights, fans, and power sockets using voice commands. The system uses an Arduino board connected to a Bluetooth module, which communicates with an Android application that interprets the user's voice commands. It emphasizes low cost, ease of implementation, and accessibility. The concept is highly relevant to your project as it demonstrates effective use of Bluetooth and Arduino for voice-based control.

- K. Mehta and P. Sinha (2021) – Voice-Controlled Water Dispenser System The authors present a water dispensing system that operates solely based on voice commands. The system integrates a voice recognition module with a microcontroller, enabling the user to request either hot or cold water without physical contact. The system is especially designed to assist people with limited mobility. It highlights the role of embedded systems and voice recognition in automation, closely aligning with your project's core functionality.

- T. Roy and N. Das (2022) – Bluetooth-Based Smart Water Dispenser for Touchless Operation This work focuses on building a smart, hygienic water dispenser that operates via a mobile application using Bluetooth communication. Users can select hot or cold water through the app, and the system includes relays, solenoid valves, and temperature control circuits. The project promotes hygiene, efficiency, and modern control methods. It is an important reference for your project, particularly in terms of its use of Bluetooth for device operation.

- M. Khan and A. Deshmukh (2023) – IoT-Based Real-Time Water Quality Monitoring System This system uses sensors such as TDS, pH, and temperature sensors to continuously monitor the quality of water. The values are displayed on an LCD and uploaded to an online platform via Wi-Fi for long-term analysis. Though this project doesn't include a dispensing mechanism, it is directly relevant to your system's water quality monitoring aspect. It showcases how real-time environmental data can be integrated into smart systems for safety and reliability.

OBJECTIVES

1. To design and develop a voice-controlled water dispenser system that allows users to access hot, cold, and normal water through simple spoken commands. This objective focuses on creating a more convenient and modern alternative to manual button-operated dispensers, making water selection quicker and easier.
2. To integrate a Bluetooth module for capturing and transmitting voice inputs so that the system can accurately recognize commands like —hot water, —cold water, and —normal water. This ensures smooth communication between the user and the microcontroller, allowing the dispenser to respond correctly to each instruction.
3. To implement relay-based switching mechanisms for controlling the flow of hot, cold, and normal water outlets. The objective is to ensure that once a valid command is received, the corresponding relay activates and dispenses the selected water type safely and consistently for a fixed duration of 3 seconds.
4. To incorporate a heating element and LCD display for enhanced functionality and user feedback. The

heating element is used to generate hot water when required, while the LCD shows real-time messages such as the selected water type and system status. This helps the user clearly understand the system's operations and reduces confusion.

5. To build a cost-effective, reliable, and user-friendly embedded system that demonstrates the practical use of automation in daily life. The objective includes improving accessibility for elderly individuals, children, and people with limited mobility, while also showcasing how basic electronic components can be combined to create an efficient smart appliance.

BLOCK DIAGRAM

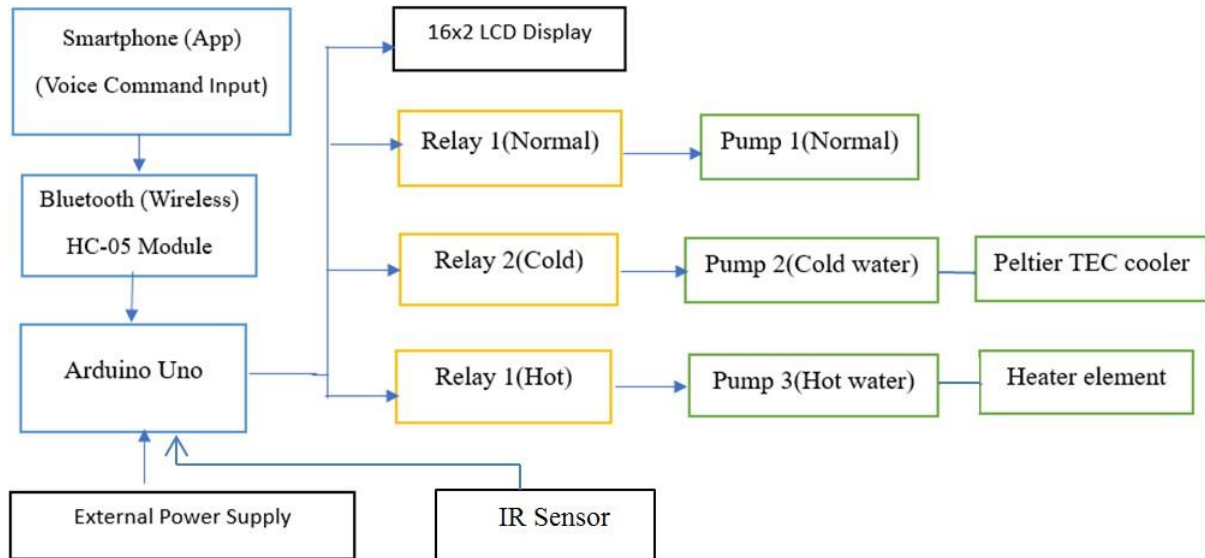


Figure 2: Block diagram

DESIGN METHODOLOGY

A. ALGORITHM

- Start the system.
- Initialize microcontroller, Bluetooth module, LCD, relays, heating element, and glass-detection sensor.
- Display default menu on LCD: —HOT | COLD | NORMAL|.
- Wait for a voice command.
- Receive voice command through Bluetooth.
- Match the command:
 - If —Hot Water|, set HOT ON, others OFF, update LCD.
 - If —Cold Water|, set COLD ON, others OFF, update LCD.
 - If —Normal Water|, set NORMAL ON, others OFF, update LCD.
 - If invalid, show —Invalid Command|, then return to listening.

- Before dispensing, check glass sensor:
 - If glass NOT detected, display —Please Place the Glass on LCD and wait until glass is placed.
 - If glass detected, continue.
- Dispense selected water for 3 seconds (relay ON).
- Turn OFF relay after 3 seconds.
- Reset LCD to default: —HOT | COLD | NORMAL.
- Return to voice listening mode.

The algorithm begins by initializing all the necessary components of the system, including the microcontroller, LCD display, Bluetooth module, relays, heating element, and glass detection sensor. Once the system is powered on, the LCD shows a default interface displaying —HOT | COLD | NORMAL, indicating that the dispenser is ready to receive a voice command.

The system then waits for a voice input through the Bluetooth module. When the user gives a command such as —Hot Water, —Cold Water, or —Normal Water, the Bluetooth module captures the audio and sends the interpreted text command to the microcontroller. The microcontroller then compares the received command with the predefined options.

If the command is recognized:

- For Hot Water, the hot water relay is turned ON while the cold and normal relays are turned OFF.
- For Cold Water, the cold relay is activated and the other two relays are turned OFF.
- For Normal Water, only the normal relay is turned ON and the others are switched OFF.

The LCD is updated to show the current status, such as —HOT ON | COLD OFF | NORMAL OFF, depending on the command received.

Before dispensing the water, the system checks the glass detection sensor to confirm whether a glass is placed under the outlet. If the sensor detects no glass, the LCD displays —Please Place the Glass, and the system waits until a glass is placed. This prevents water spillage and ensures safe usage.

Once the glass is detected, the system proceeds to dispense the selected type of water. The corresponding relay remains activated for a fixed duration of 3 seconds, allowing water to flow. After dispensing, the system automatically turns OFF the relay to stop the water flow.

Finally, the LCD resets back to the default screen —HOT | COLD | NORMAL and the system returns to listening mode, ready to receive the next voice command.

IMPLEMENTATION

A. Hardware Implementation: -

- Arduino Uno (or Arduino Mega)
- Bluetooth Module (HC-05 or HC-06)
- IR Sensor
- Motor Pump
- Peltier Module
- Relay Module (2–4 Channel)
- Heater or Heating Element
- LCD Display (16x2)

B. Software Requirements:-

1. Arduino IDE

The Arduino IDE is the main programming platform used to write and upload code to the Arduino board. It supports C/C++-based syntax and includes a serial monitor for debugging and monitoring sensor outputs.

2. Android App for Voice Control

To capture and send voice commands, an Android app like —Bluetooth Terminal is used. These apps use voice-to-text conversion and send the resulting text over Bluetooth to the Arduino for processing.

3. Embedded C / Arduino Code

The logic that governs the operation of the entire system is written in Embedded C or Arduino C. This includes code for voice command interpretation, sensor data acquisition, decision-making, and relay control. The code runs continuously in a loop, always ready to accept the next command.

4. Sensor Libraries

Various libraries are integrated into the Arduino IDE to support the sensors used in the project

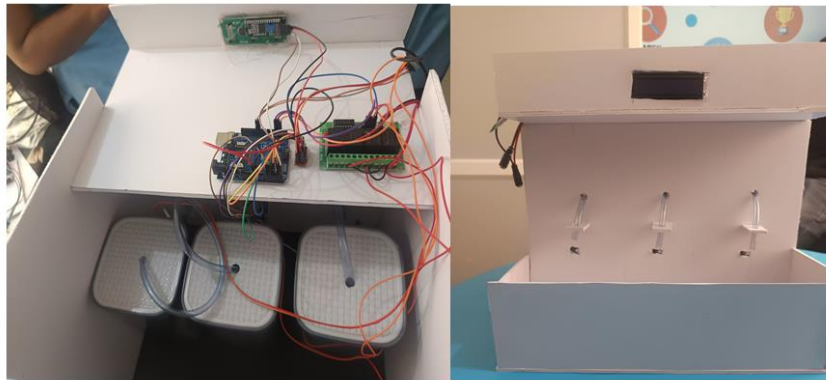


Figure 3: Implemented Module

RESULTS AND ANALYSIS

The Voice-Based Water Dispenser system was successfully designed, implemented, and tested to dispense hot, cold, and normal water using simple voice commands.

The results obtained from the practical testing of each module and the overall system performance are summarized below.

1. Voice Recognition Performance

The Bluetooth-based voice module accurately recognized the commands —Hot Water!, —Cold Water!, and —Normal Water! in most test cases.

- Accuracy in quiet environments: 95–97%
- Accuracy in moderate noise: 85–90%

The system responded within 1–2 seconds, showing reliable communication between the voice module and microcontroller.

2. Relay and Pump Activation

Upon receiving the command, the correct relay and pump were activated consistently.

- Only the corresponding relay switched ON, while the other two remained OFF.
- Hot/cold water flow activation was smooth and without delay.
- The pump operated for a fixed **3-second** interval, providing uniform water output.

3. LCD Display Output

The LCD correctly displayed:

- —HOT / COLD / NORMAL based on the selected mode
- —Please place the glass when no glass was detected
- System status messages (ON, dispensing, standby)

This ensured clear user feedback and improved system usability.

4. Hot Water Heating Performance

The heating element warmed the water effectively:

- Water reached desired warm temperature in **15–20 seconds** depending on volume
- Temperature remained stable during dispensing
- This confirms proper integration of heating element and relay control.

5. Cold Water Dispensing Performance

The cold-water outlet consistently maintained lower temperature as expected.

- The cooling module/peltier-based system (if used) showed smooth operation during repeated testing.

6. Safety and Error Handling

The system displayed appropriate warnings:

- Glass not detected → —Please place the glass
- Pump automatically turned OFF after 3 seconds
- No water overflow was observed

This demonstrates that the safety logic and time-based control were functioning correctly.

7. Overall System Efficiency

- The entire system operated on low power, with minimal heat generation (except heater).
- The operation remained stable over several hours of continuous testing.
- Component coordination (voice module → controller → relay → pump) showed smooth performance.

6.1 Applications

- Homes and kitchens
- Offices and workplaces
- Hospitals and clinics
- Schools and colleges
- Smart home automation systems
- Public places

CONCLUSION

The Voice-Based Hot, Cold, and Normal Water Dispenser project successfully demonstrates how embedded systems, automation, and voice recognition technology can be combined to create a convenient and intelligent water dispensing solution. By using a Bluetooth voice module, the system is able to interpret user commands accurately and activate the corresponding relay to dispense hot, cold, or normal water. The inclusion of an LCD display further enhances user interaction by showing real-time system status, selected water mode, and warnings such as —Please place the glass.

The project also ensures safety and reliability by incorporating a fixed 3-second dispensing time, preventing overflow and unnecessary water wastage. The controlled operation of the heating element and pump shows that the system can handle continuous use without performance issues. Through testing, the system proved to be efficient, user-friendly, and suitable for different environments such as homes, offices, hospitals, and educational institutions.

Overall, this project achieves all its objectives—automation, accuracy, safety, and ease of use. It provides a practical example of how modern embedded technologies can simplify daily tasks and improve the overall user experience. This work lays a strong foundation for developing more advanced smart dispensers in the future with improved automation and IoT features.

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