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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# IOT Based Water Heater Temperature Controller

**Dr. A. R Jayasudha, Nantha Kumar G**

HOD, Department of Master of Computer Applications, Hindusthan College of Engineering and Technology,  
Coimbatore, India

II MCA Students, Department of Master of Computer Applications, Hindusthan College of Engineering and  
Technology, Coimbatore, India

**ABSTRACT:** Smart water heating systems have become an important topic in all applications, especially industrial applications with a wide range of efficient temperatures. The system basically includes a voltage regulator, a dry resistor, a temperature sensor, an LCD, a relay, a heater, and a microcontroller. The temperature difference on the surface of the processor allows for rapid heat storage. Arduino NANO is used to regulate voltage, sense temperature and make production. The concept of draft is devised, created and evaluated. After adjusting the temperature to various levels and checking the final output, the heater turned on / off when the unit exceeded the set value. Therefore, the temperatures in cold and hot regions are more efficient at reaching thermal equilibrium as the water rises.

## I. INTRODUCTION

A temperature controller is a device used to control the temperature of an object, the space inside a container or room, and so on. The temperature sensor measures the ambient temperature and controls the heating or cooling mechanism to maintain the set temperature range. If the ambient temperature is above or below the set temperature it automatically operates the heating mechanism to raise the temperature to the desired level. Here, the temperature is measured using the DS18B20. The heater is controlled by a 5V relay module, and Arduino digital pins send signals to the relay module. Therefore, any changing of temperature mechanism with external DC or AC power can be used in the circuit. Make sure that the rated load does not exceed the rating of the relay module.

## II. RELATED WORK

The existing systems for water heating and temperature control, primarily relying on the Atmel 89C51 microcontroller, are confronted with a series of challenges that necessitate a comprehensive reevaluation. The intricate nature of the manufacturing process associated with these systems, coupled with the dependency on external components such as AD converters, external clocks, and specialized development boards, contributes to a host of inefficiencies and drawbacks.

### **Complexity and Time Consumption:**

The utilization of the Atmel 89C51 microcontroller introduces a level of complexity in the manufacturing process that proves cumbersome. The need for additional components, including AD converters and external clocks, elongates the development timeline, rendering the process time-consuming.

### **External Dependencies:**

The reliance on external components, particularly the external clock, poses a significant challenge. The requirement for an external clock introduces an external dependency, making the system susceptible to clock-related issues and potential disruptions in operation.

### **Programming Difficulties:**

The programming intricacies associated with the Atmel 89C51 microcontroller present a formidable challenge. The complexities in programming can lead to difficulties in system customization, adaptability, and overall operability, posing a barrier to widespread use.

**Increased Circuit Size:**

The integration of the Atmel 89C51, along with the requisite external components, contributes to an increase in the overall size of the circuit. This expanded physical footprint not only poses challenges in terms of space utilization but also complicates the manufacturing and installation processes.

**Manufacturing Complications:**

The overall manufacturing process for systems relying on the Atmel 89C51 microcontroller is marred by complications. The inclusion of additional equipment, such as development boards, further contributes to the intricacies, making the production of these systems both challenging and less streamlined.

**SCOPE**

The scope of this paper extends across various dimensions, encompassing both the technological and practical aspects of smart water heating systems. The focus revolves around addressing the limitations of existing systems, particularly those reliant on the Atmel 89C51 microcontroller, and proposing a comprehensive solution leveraging the Arduino microcontroller. The following key areas define the scope of the paper:

**III. SYSTEM ANALYSIS****EXISTING SYSTEM**

The existing system for water heating and temperature control relies on the Atmel 89C51 microcontroller. This microcontroller-driven system consists of four main components: a process, an analog-to-digital converter, a control algorithm, and an external clock. The analog signal from the process is converted to a digital format during the sampling time. Challenges associated with the existing system include time consumption, additional equipment requirements, external clock dependency, programming difficulties, increased circuit size, and complex PCB manufacturing. The temperature control system may face limitations in precision and adaptability, leading to potential energy efficiency challenges and a lack of adaptability to diverse environments. These drawbacks prompt the exploration of an alternative solution using the Arduino microcontroller.

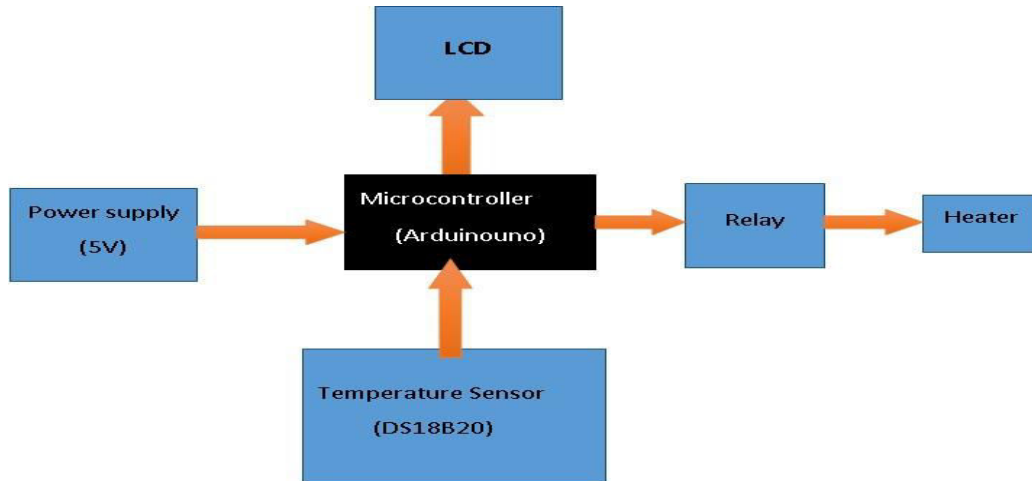
**PROPOSED SYSTEM**

The proposed system aims to overcome the limitations associated with the existing water heating and temperature control systems, particularly those relying on the Atmel 89C51 microcontroller. Instead, the paper suggests an innovative approach utilizing the Arduino microcontroller. Key aspects of the proposed system include:

- The adoption of the Arduino (ATmega8) microcontroller for enhanced efficiency and flexibility in temperature regulation.
- Integration of components such as the DS18B20 temperature sensor, 16x2 LCD, relay, and buzzer with the Arduino microcontroller.
- Utilization of the DS18B20 temperature sensor to detect ambient temperature, which is then processed by the Arduino to control the heating mechanism.
- The incorporation of a relay module controlled by Arduino digital pins for switching the heating device on or off based on temperature levels.
- Presentation of the system's output on a 16x2 LCD, providing real-time information on ambient temperature in both Celsius and Fahrenheit.



## **BLOCK DIAGRAM**



## **BLOCK EXPLANATION**

The block diagram illustrates the main components and their connections within the smart water heating system using Arduino Nano. The central component is the Arduino Nano microcontroller, responsible for processing data and making control decisions. Connected to the Arduino Nano are various functional blocks:

### **Sensor Interface (DS18B20):**

This block represents the temperature sensor (DS18B20) that measures the ambient temperature. The data from the sensor is sent to the Arduino Nano for processing.

### **Display Interface (16x2 LCD):**

This block signifies the 16x2 LCD display, which visually presents real-time ambient temperature information in both Celsius and Fahrenheit. The display interacts with the Arduino Nano to receive temperature data.

### **Relay Control (Heating Device):**

The relay control block is responsible for managing the heating device, such as a heater. It receives signals from the Arduino Nano, determining when to activate or deactivate the heating device based on temperature conditions.

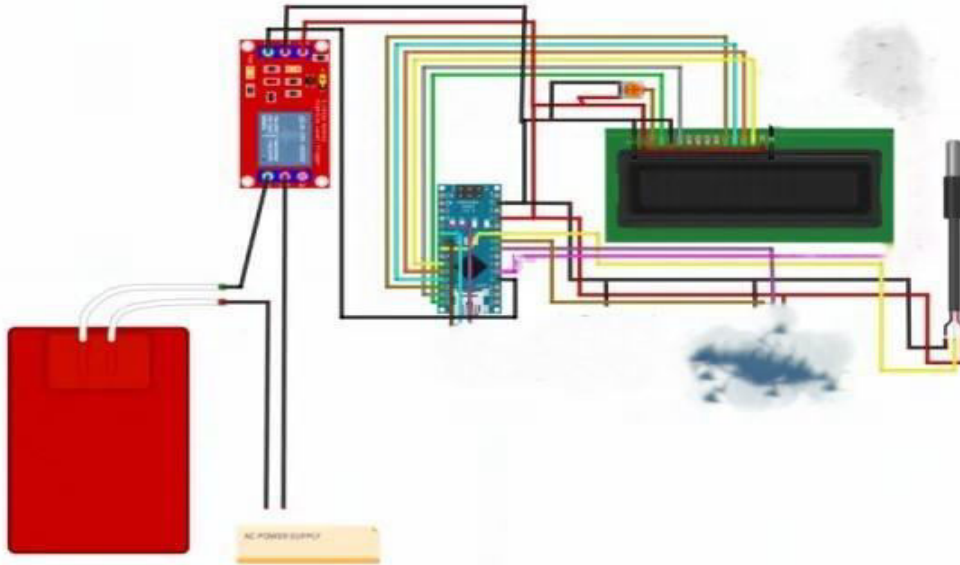
### **Voltage Regulation:**

This block ensures a stable power supply by regulating the incoming power. It may include a voltage regulator to prevent issues caused by power fluctuations.

### **Buzzer Interface:**

Connected to the Arduino Nano, this block represents a buzzer providing audible alerts or notifications based on specific events or conditions in the system.

## CIRCUIT DIAGRAM



## IV. SYSTEM SPECIFICATION

### HARDWARE REQUIRMENTS

#### DS18B20 Temperature Sensor:

A digital temperature sensor capable of measuring ambient temperature. It provides a digital output that is read by the Arduino for temperature control.

#### 16x2 LCD Display:

A liquid crystal display (LCD) with a 16x2 character configuration for real-time visualization of the system output. The display is used to showcase ambient temperature in both Celsius and Fahrenheit.

#### Relay Module:

A relay module is employed to control the heating device (e.g., a heater) based on temperature conditions. The relay acts as a switch, turning the heating device on or off as directed by the Arduino.

#### Microcontroller (Arduino-Compatible):

The system utilizes a microcontroller, such as the Arduino (ATmega8), for processing data, implementing control algorithms, and managing input/output operations.

#### Additional Components (Wires, Connectors, Breadboard, etc.):

Various wires, connectors, and a breadboard may be required for establishing electrical connections between different components, creating a prototype, and ensuring reliable communication within the system.

#### Power Source:

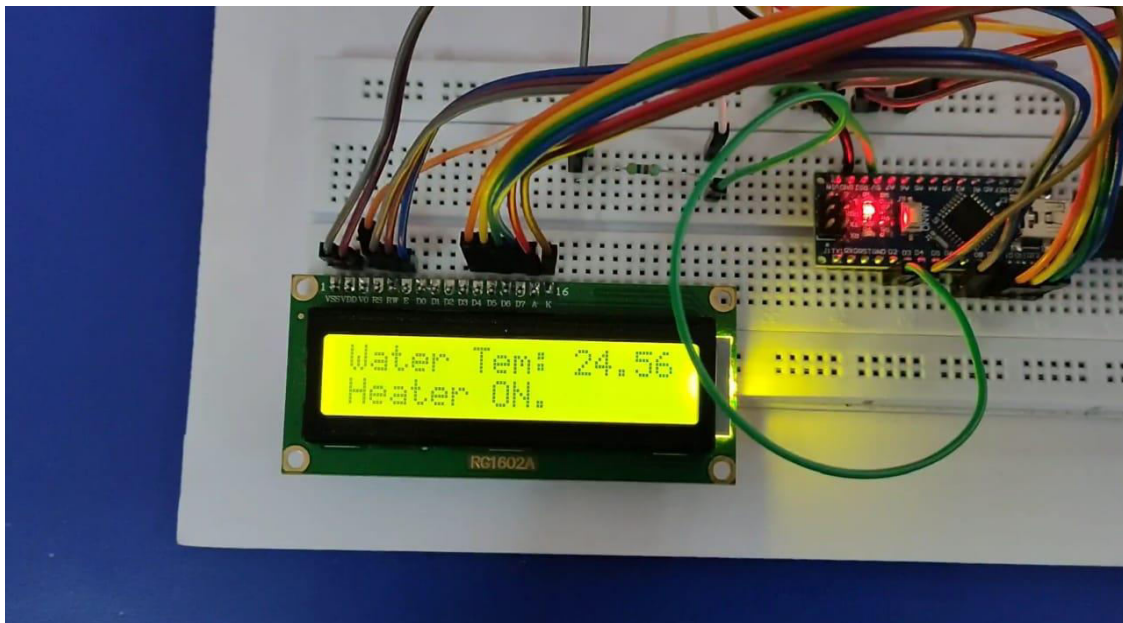
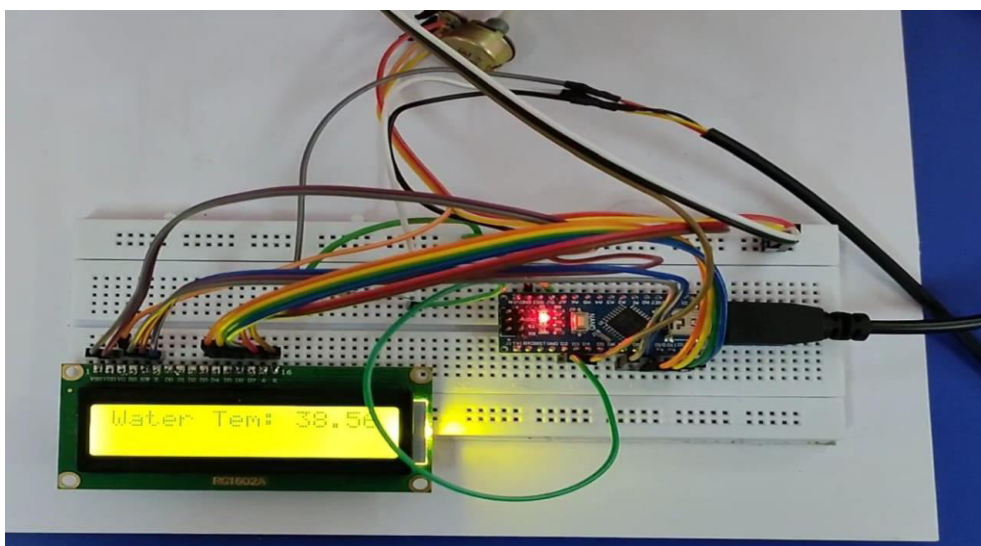
Depending on the specific application, a suitable power source is needed to supply electrical energy to the system. This may include batteries, an external power supply, or other power solutions.

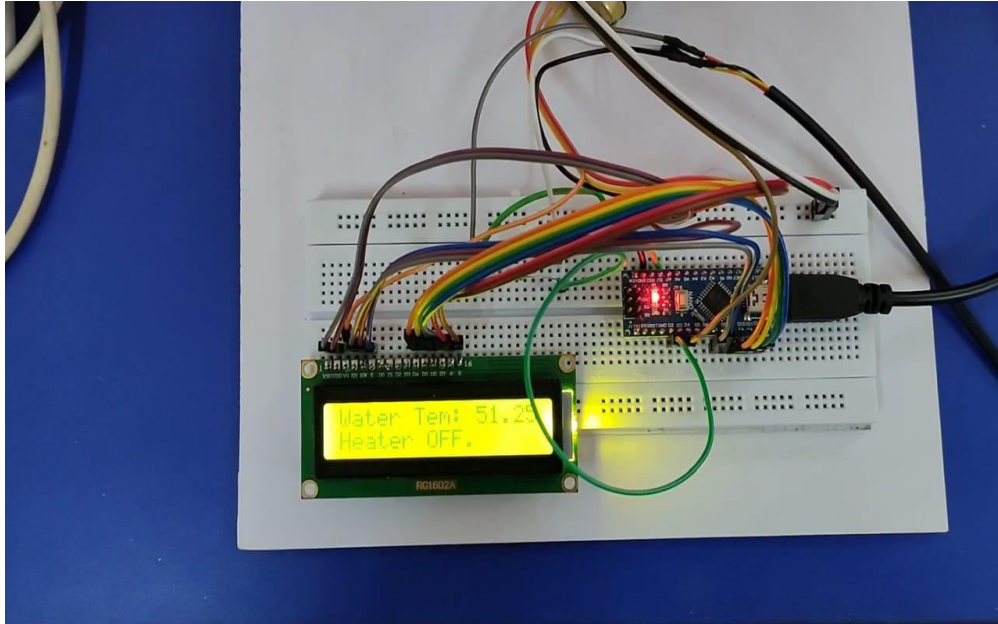
### SOFTWARE REQUIRMENTS

Object system - Windows 10  
IDE - Arduinonano

**FUTURE ENHANCEMENT**

The paper concludes with a succinct summary of the achieved results and underscores the significance of the proposed smart water heating system. The advantages, including flexibility, energy efficiency, ease of use, and reliability, are highlighted. The narrative seamlessly transitions to recommendations, suggesting the application of such systems in workplaces, potential enhancements with additional modules, and the exploration of alternative energy sources

**V. RESULTS****HEATER IS ON****INCREASE TEMPERATURE LEVEL**



**HEATER IS OFF**

## **VI. CONCLUSION**

The smart water heater system using Arduino proves beneficial in energy management and control. The system's advantages include flexibility, energy efficiency, ease of use, reliability, and automatic switching of heating and cooling devices. Recommendations include application in workplaces, further development with additional modules, and exploration of alternative energy sources.

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