iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** VI **Month of publication:** June 2025

DOI: https://doi.org/10.22214/ijraset.2025.72481

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VI June 2025- Available at www.ijraset.com

Design and Implementation of an Automated Geyser Temperature Control System Using ESP32

Vishvas Natu[1], Vedant Hinge[2], Harsh Shankar[3]
Anantrao Pawar College of Engineering and Research

Abstract: ***This paper presents a smart and cost-effective geyser temperature control system designed using an ESP32 microcontroller. The system is intended to ensure user comfort, energy efficiency, and water conservation by automating the control of heater and water flow based on temperature feedback. The project utilizes components including solenoid valves, a diaphragm pump, DS18B20 temperature sensor, a 2-channel relay module, an RTC module, an LCD display, and is integrated with the Blynk mobile app for remote operation. This paper discusses the design, development, working methodology, experimental analysis, validation, and future scope of the system.***

I. INTRODUCTION

Hot water is essential for daily activities in every household, and traditional geysers often run inefficiently due to manual operation. This results in unnecessary power consumption, water wastage, and increased utility bills. In a time when automation and smart systems are becoming more accessible, it is necessary to introduce intelligent control systems that improve energy usage and user convenience. This project focuses on the development of a low-cost, automated temperature control system for water heaters using the ESP32 microcontroller. It integrates digital sensors, control logic, and user-friendly remote access to ensure optimal heating cycles. Furthermore, the system promotes water conservation by managing flow based on preset temperature thresholds. The proposed design finds application in homes, hostels, and commercial spaces where temperature-regulated hot water supply is essential.

II. LITERATURE REVIEW

Several attempts have been made to automate water heating systems. Previous works have incorporated microcontrollers, wireless connectivity, and various types of temperature sensors to improve system performance. The integration of mobile applications for user interaction has further enhanced the usability of these systems. This paper builds upon prior research by implementing a dual-relay control for outlet and return lines, independent motor operation, and LCD display for on-site monitoring.

III. METHODOLOGY

1) Temperature sensed using DS18B20 is used to determine control logic.
2) ESP32 reads data and activates relays accordingly:
   - Relay 1 controls the return solenoid (opens below threshold).
   - Relay 2 controls heater and outlet valve (operates above threshold).
3) Diaphragm pump functions independently for water circulation.
4) The Blynk app is used for remote monitoring, user login, and manual override.
5) LCD displays real-time status including temperature, date-time (via RTC), and device state.

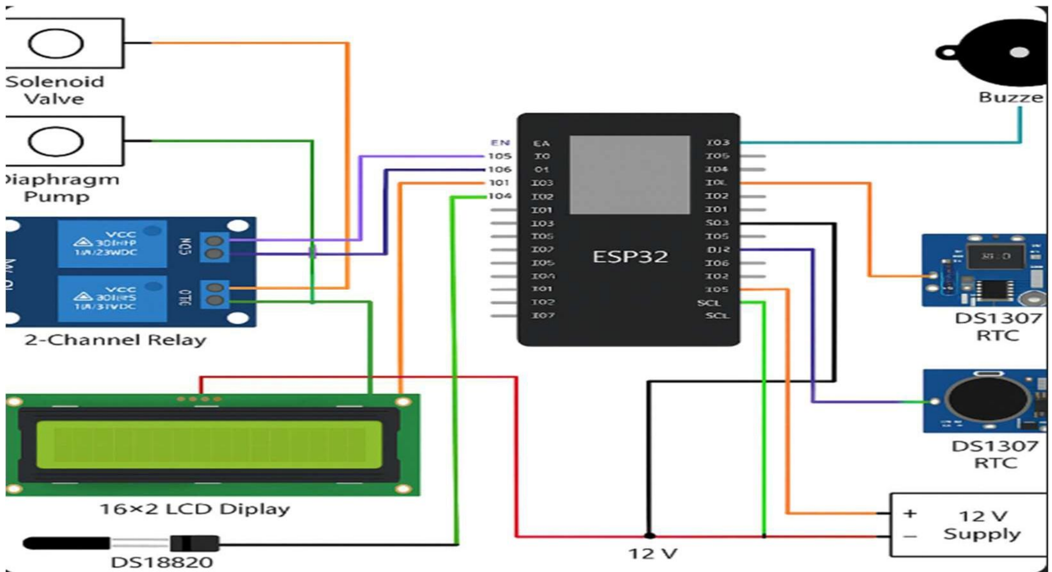
IV. COMPONENT SELECTION

Each component is selected based on compatibility, cost, reliability, and ease of integration:

1) ESP32: Dual-core microcontroller with Wi-Fi.
2) Solenoid Valves: 12V DC, normally closed.
3) DS18B20: Waterproof digital sensor.
4) LCD 16x2: With I2C interface.
5) Relay Module: Opto-isolated for safe switching.

V. EXPERIMENTAL SETUP

The system is mounted on a cardboard base. The water flow circuit is built using polyurethane pipes, valves, and a diaphragm pump. The control unit includes the ESP32 board connected to all sensors, display, and actuators. Real-time data is monitored via LCD and Blynk.



VI. VALIDATION AND RESULTS

The system was tested for different temperature thresholds. The response of relays, heater activation, and valve operation were found to be consistent. Data loss was minimized and system resets occurred rarely under unstable power conditions. Temperature accuracy was maintained within ±0.5°C, and all actuators responded within 2 seconds of command.

VII. DISCUSSION

The system offers a reliable and safe solution for smart geyser control. It minimizes user intervention, optimizes energy consumption, and enhances safety. Potential improvements include waterproof enclosures, OTA firmware updates, and solar power integration. The use of open-source platforms and low-cost components makes the system replicable for educational, domestic, and small commercial uses.

VIII. APPLICATIONS

1) Domestic hot water systems
2) Hostel and dormitory bathrooms
3) Energy-efficient apartment buildings
4) Hotels with water conservation practices
5) Institutional buildings requiring regulated hot water

IX. CONCLUSION

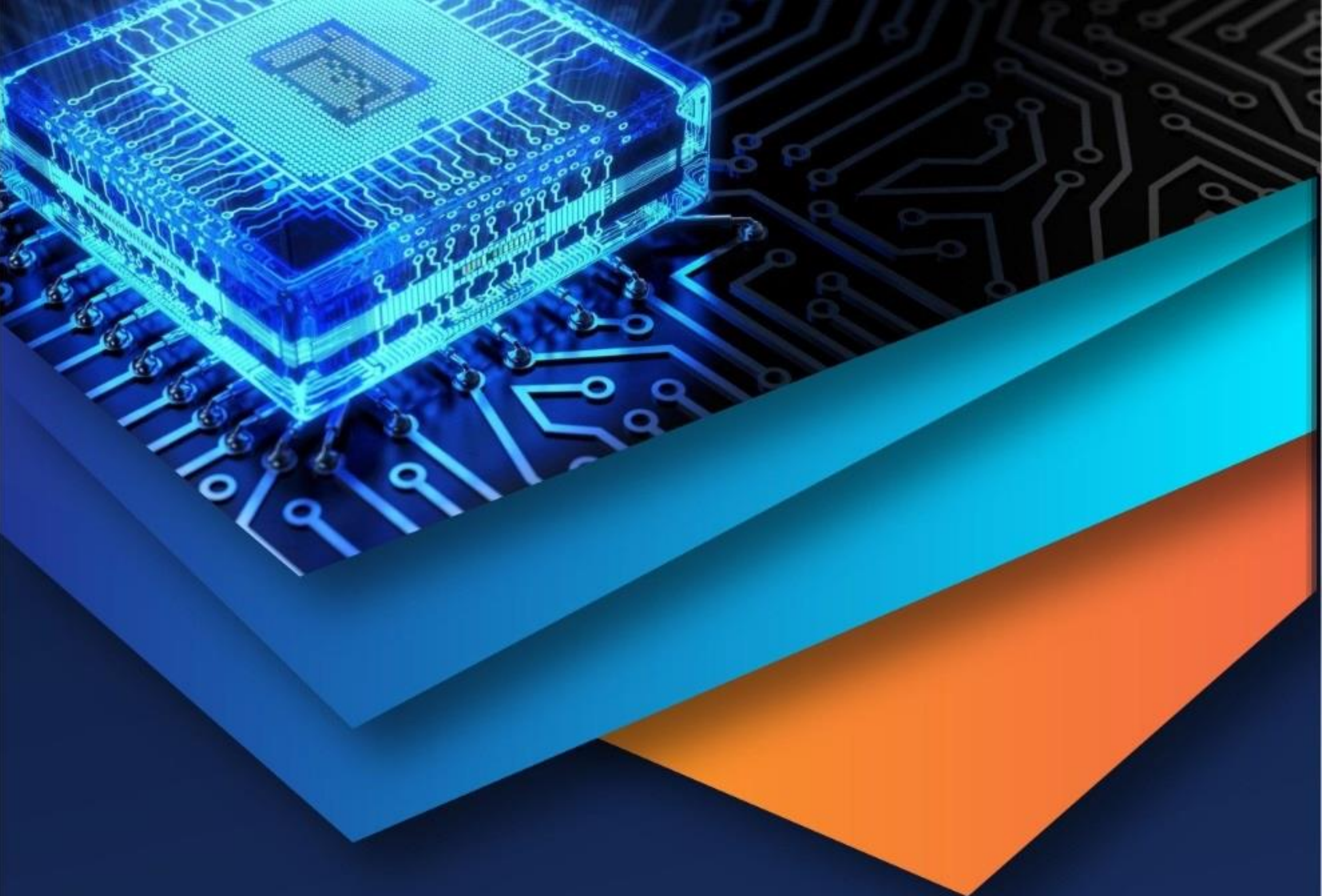
The automated geyser temperature control system presented in this paper effectively enhances comfort, safety, and energy efficiency. The use of ESP32 and mobile interfacing provides scalability and remote control features. With further improvements, this solution can be commercialized for wider deployment. The system also fosters awareness about responsible water and energy usage, contributing to a more sustainable future.

X. FUTURE SCOPE

1) Addition of real-time cloud data logging
2) Integration with voice assistants like Google Home or Alexa
3) Solar-powered variant for eco-friendly operation
4) Dynamic learning algorithm to adjust heating cycles based on user behavior
5) Modular extension to support multiple geysers in large buildings

REFERENCES

[1] Harish Mekali et al., "Design and Development of Automatic Temperature Control System for Solar Water Heater System," IEEE PECon, 2018.
[2] T. Wangchuk et al., "Solar Water Heater using an IoT," IJRASET, 2024.
[3] H. Pipino et al., "Nonlinear Temperature Regulation of Solar Collectors," arXiv, 2020.
[4] A. Maleki et al., "Applications of Intelligent Methods in Solar Heaters," Renew. Energy Rev., 2023.
[5] C. Passenberg et al., "Optimal Water Heater Control in Smart Home Environments," arXiv, 2016.
[6] B. Rao and M. Bindu, "IoT Based Smart Water Heating System," IJESC, 2022.
[7] K. Nithya et al., "Temperature Monitoring for Smart Geyser using Arduino," IJERT, 2021.
[8] H. Garg et al., "Thermal Performance of Flat Plate Collector with Temperature Control," IJAERS, 2019.
[9] R. Nayak and V. Bansal, "Smart Solar Geyser using Embedded Technology," IJIERT, 2020.
[10] G. Zeng et al., "Energy Management in Domestic Heating Systems using AI," Elsevier Energy, 2023.
[11] P. Rajput et al., "Home Automation of Geyser with Safety Monitoring," IRJET, 2021.
[12] S. Mitra, "Design of IoT Based Water Heating Systems," IJERT, 2022.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY