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Hot Water Dispenser System using RFID with Temperature Controlling for College Hostel

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Abstract: *The "Hot Water Dispenser System utilizing RFID for Water Temperature Regulation in College Hostels" introduces an innovative solution aimed at improving the efficiency and user satisfaction of hot water distribution within college hostels. This system adopts Radio-Frequency Identification (RFID) technology as a secure means of access, assigning each student a unique RFID card for personalized entry. Furthermore, it integrates precise water temperature control facilitated by a dedicated temperature sensor, granting users the ability to adjust to their preferred temperature settings. To ensure equitable usage and optimize energy consumption, a policy of single-use per day per RFID card is enforced. The system's core operations are managed by an Arduino microcontroller, orchestrating seamless communication among the RFID reader, temperature sensor, relay, water pump, and a real-time display module. This module furnishes users with immediate feedback regarding water temperature, user credentials, and overall system status. By amalgamating security, convenience, and energy efficiency, this initiative not only meets the immediate needs of hostel dwellers but also espouses contemporary principles of sustainability and prudent resource stewardship.*

Keywords: RFID, Technology, Hot water dispenser, College hostel, Temperature control

I. INTRODUCTION

In the realm of contemporary technology, the incorporation of intelligent systems into everyday utilities has become essential for ensuring effectiveness, convenience, and resource optimization. One notable area that has seen significant progress is the provision of hot water in communal settings, such as college hostels. Recognizing the necessity for a sophisticated and controlled hot water dispensing system, we propose the development of a cutting-edge "Hot Water Dispenser System using RFID with Water Temperature Control for College Hostel."

Traditional methods of water dispensing in educational institutions often lack precision and customization tailored to individual users, leading to unnecessary energy consumption and operational inefficiencies. Our project aims to tackle these challenges by leveraging Radio-Frequency Identification (RFID) technology to streamline and personalize the hot water dispensing process. Through the integration of an Arduino microcontroller, relay, water pump, temperature sensor, RFID reader, and display module, our system aims to transform how students access hot water in hostel environments.

At the core of our Hot Water Dispenser System lies the use of RFID cards, each uniquely assigned to a student. This innovative approach not only enhances security but also ensures that every student has exclusive access to the hot water dispensing system. The RFID cards act as personal keys, granting access to the system and allowing students to set their preferred water temperature with a single swipe. This not only reduces the risk of unauthorized usage but also optimizes the overall system operation.

The Arduino microcontroller serves as the central processing unit of the system, coordinating the seamless interaction among various components. The relay is utilized to regulate the water pump, facilitating precise hot water dispensing according to the user's specified temperature. The inclusion of a temperature sensor is crucial for monitoring the water temperature, ensuring alignment with the user's preferences. Additionally, the RFID reader plays a vital role in reading the unique identification of the student's card, granting access, and initiating the water dispensing process.

To enhance user experience and provide real-time feedback, a display module is integrated into the system. This module not only presents the current water temperature but also showcases relevant information such as the user's name

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and remaining hot water credits for the day. This transparency not only encourages responsible water usage but also empowers users with the knowledge to make informed decisions regarding their hot water consumption.

The implementation of our Hot Water Dispenser System offers numerous benefits for both students and the institution. By adopting RFID technology, the system ensures a secure and user-specific approach to hot water dispensing, mitigating the risks associated with unauthorized usage. The inclusion of temperature control not only caters to individual preferences but also promotes energy efficiency by avoiding unnecessary heating of water beyond the desired temperature.

In a hostel environment, where multiple students share resources, the system's capability to restrict each student to one card usage per day ensures equitable distribution of resources and prevents misuse of the facility. This not only aligns with sustainable practices but also fosters a sense of responsibility among users

Moreover, the real-time monitoring and display of water temperature and usage statistics contribute to an informed and conscientious user base. Students can assess their hot water consumption, adjust their preferences, and contribute to the overall conservation of resources.

1.1 Objective

- Implement RFID technology for secure and personalized access to the hot water dispenser system.
- Enable precise water temperature control, allowing users to set their preferred temperature.
- Enforce a single-use policy per day per RFID card to promote fair usage and conserve energy.
- Utilize an Arduino microcontroller to orchestrate the interaction between system components.
- Provide real-time feedback through a display module, ensuring transparency and user awareness.

1.2 Problem Statement

The problem lies in the inefficiencies of the current hot water distribution system in a college hostel. Issues include a lack of user personalization, security concerns, and inefficient energy usage due to the absence of a fair usage policy. Unauthorized access to hot water facilities is also a potential problem. The solution involves developing a system that integrates RFID technology for secure access, temperature control for user preferences, and a single-use policy to address these issues. This approach aims to improve user satisfaction, streamline operations, and promote a more sustainable and efficient hot water distribution process within the college hostel.

1.3 Scope & Limitations

The proposed RFID-based hot water dispenser system aims to enhance security, accessibility, and user experience in college hostel environments by integrating RFID technology for personalized access and precise temperature control, thereby optimizing resource usage and fostering a safer and more efficient hot water distribution system.

Limitations:

- Limited RFID reader range may restrict system coverage.
- Complexity in integrating the system with existing hostel infrastructure.
- Potential challenges in ensuring consistent and accurate water temperature regulation.

II. LITERATURE REVIEW

"RFID Based Hostel Security System With Real Hardware Implementation"

Journal of Management Engineering and Information Technology (JMEIT), Volume -3, Issue- 3, Jun. 2016

Authors: Vijay Laxmi Kalyani, Kavita Patidar, Harshita Sharma

Description: This paper introduces an RFID-based hostel security system aimed at ensuring the safety of hostel residents. By utilizing RFID technology, the system enables efficient monitoring and access control, addressing the challenge of managing security in hostel environments. The authors present a real hardware implementation of the system, highlighting its potential in enhancing hostel security effectively.

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"RFID Card and Coin Based Water Dispensing Machine"
Authors: Diksha P. Lanjewar, Sayali A. Wanjari, Prachi P. Kuthe, Poonam P. Danao, Khushbu Patil
Description: This paper presents an integrated water dispensing system based on RFID card and coin detection mechanisms. Offering a versatile approach, the system caters to both coin and card-based transactions, facilitating the dispensing of filtered water or other liquids. The authors discuss the system's potential applications in various settings, including public areas, colleges, and government offices, highlighting its significance in water conservation efforts.

"Design and Implementation of RFID system"
5th International Multi-Conference on Systems, Signals and Devices
Authors: Zaid Al-Amir, Dr. Firas Abdullah Al-Saidi, Dr. Hussein Abdulkadir
Description: This paper presents a comprehensive design and implementation of an RFID system tailored for security applications in corporate and office settings. The authors detail the system's architecture, incorporating FSK modulation techniques for signal transmission and reception. Through successful communication between the RFID reader and tags, the system demonstrates its effectiveness in identifying employees, thereby enhancing security measures.

"Voice based Hot and Cold Water Dispenser and Display the Water Quality"
International Research Journal of Engineering and Technology (IRJET), Volume: 08 Issue: 04, Apr 2021
Authors: Mr S Vijayakumar, G Roja, G Rasika, G Sivapriya
Description: This paper introduces a novel voice-based hot and cold water dispenser system designed to cater to the needs of individuals with disabilities and the elderly. Utilizing wireless communication between mobile devices and a microcontroller, the system offers a user-friendly interface for dispensing water based on voice commands. Additionally, the system incorporates IR sensors to ensure efficient water flow, contributing to automation and technological advancements in water dispensing solutions.

"The Application of RFID System in Water Level Monitoring"
International Journal of Computer Science and Information Technology
Authors: Hairulnizam Mahdin, Hazalila Kamaludin, RD Rohmat Saedudin, Abdul Halim Omar, Shahreen Kasim, Junaidah Jailani
Description: This paper discusses the implementation of RFID technology in monitoring water levels in tanks, particularly in tropical countries like Malaysia. Highlighting the significance of automatic monitoring systems, the authors propose an RFID-based solution capable of alerting personnel about decreasing water levels. Despite challenges such as implementation costs, RFID technology shows potential in enhancing water management practices by providing timely alerts and improving accessibility to water level information.

III. MATERIALS AND METHODS

Methodology
The methodology for the "Hot Water Dispenser System using RFID with Water Temperature Controlling for College Hostel" involves a systematic approach to address the existing challenges in the current hot water distribution system. Initial stages encompass a thorough requirement analysis, identifying user needs, security considerations, and energy efficiency goals. Subsequently, the system design phase defines the architecture, detailing the interaction between RFID technology, temperature control, and the Arduino microcontroller. A comprehensive plan is formulated to implement a single-use policy efficiently.
The hardware implementation stage involves assembling the necessary components, including RFID readers, temperature sensors, relays, water pumps, and the Arduino microcontroller. This phase ensures seamless integration to create a cohesive and functional system. Concurrently, software development focuses on programming the Arduino microcontroller to manage RFID authentication, temperature control, and enforce the single-use policy.
Following the hardware and software integration, rigorous testing and validation are conducted to ensure the proper functioning of the entire system. This includes validating RFID card access, assessing temperature control accuracy, and confirming adherence to the single-use policy. Throughout the process, calibration tools for temperature sensors

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and testing equipment, such as multimeters and oscilloscopes, are employed to guarantee the reliability and accuracy of the developed system.

The tools utilized in this project include the Arduino IDE for efficient code development, RFID software for secure card authentication, calibration tools for temperature sensor accuracy, real-time display modules for user feedback, and testing equipment for system validation. This comprehensive methodology ensures the successful implementation of an advanced and efficient hot water dispensing system tailored for the college hostel environment.

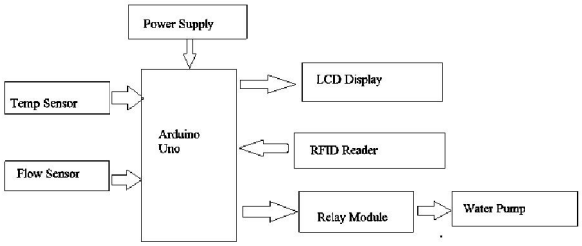

Figure 1: System Architecture.

Hardware Components

- Arduino Uno R3:
- Operating Voltage: 5V
- Recommended Input Voltage: 7-12V
- Input Voltage Limit: 6-20V
- Analog I/O Pins: 6
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins: 6
- DC Current per I/O Pin (mA): 40
- DC Current for 3.3V Pin (mA): 50

The Arduino Uno R3 serves as the main microcontroller board for your project. It operates on 5V and can accept input voltages ranging from 7V to 12V, with a limit of 6V to 20V. It provides a variety of analog and digital I/O pins, making it suitable for interfacing with sensors, displays, and other peripherals.

DS18B20 Sensor:

- Communication Protocol: One-Wire
- Resolution: Up to 12 bits
- Temperature Range: -55°C to +125°C
- Number of Sensors Supported: Multiple
- Power Mode: Parasite power mode available
- Waterproof: Some variants available

The DS18B20 sensor communicates using the One-Wire protocol and provides high-precision temperature measurements with a resolution of up to 12 bits. It operates over a wide temperature range and supports multiple sensors on a single bus. Some variants come in waterproof packages, suitable for outdoor or wet environments.

LCD Display with I2C Interface:

- Interface: I2C
- Character: 16x2
- Backlight Color: Blue
- Input Voltage: 5V
- Dimensions: Length: 80mm, Width: 36mm, Height: 18mm

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The LCD display features a 16x2 character display with a blue backlight. It uses the I2C interface, reducing the number of wires required for connection. The display can show text or numerical values read from sensors, making it suitable for providing visual feedback in your project.

Relay Module:

- Number of Channels: 1
- Operating Voltage: 12V
- Maximum Current Rating: 10A/250V AC or 15A/125V AC
- Control Input Voltage Range: 4V to 12V

The relay module allows you to control high-power appliances directly from the Arduino. It features a single relay channel capable of handling significant current loads. It accepts control inputs within a range of 4V to 12V, making it compatible with various microcontrollers.

DC Water Pump:

- Height: About 33mm
- Length: Approximately 45mm
- Diameter: Approximately 24mm
- Flow Rate: 80-120L/H
- Maximum Lift: 40-110cm
- Outer Diameter of Effluent: 7.5mm/0.3″

The DC water pump is a submersible pump suitable for various applications such as pumping water from septic tanks or flooded areas. It operates on DC power and has specific dimensions, flow rate, and maximum lift capability.

Buzzer:

The buzzer is an audio signal device used for generating audible alerts or notifications in your project. It is typically connected to a microcontroller pin and activated when required.

Optocoupler PC817:

- Package Type: 4-pin DIP
- Isolation Voltage: 5kV
- Collector-Emitter Voltage: 80V
- Current Transfer Ratio: Minimum 50% at IF=5mA, VCE=5V

The optocoupler PC817 provides electrical isolation between different parts of the circuit. It consists of an infrared emitter and phototransistor packaged in a DIP package, with high isolation voltage and current transfer ratio.

Transistor BC547:

The BC547 transistor is a general-purpose NPN transistor used for amplifying or switching electronic signals in the circuit.

Diode 1N4007:

The 1N4007 diode is used for rectification purposes in the power supply circuit, allowing current flow in one direction while blocking it in the opposite direction.

Capacitors and Resistors:

These passive components are used for various purposes such as energy storage (capacitors) and controlling current flow (resistors) in the circuit. Different values of capacitors and resistors are used for specific functions in the project.

Transformer:

The 12-0-12 2 Ampere Center Tapped Step Down Transformer is used for stepping down the input AC voltage to a lower AC voltage suitable for the circuit. It includes specifications such as input and output voltage, current, and mounting type.

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IV. RESULTS AND DISCUSSION

The implementation of the "Hot Water Dispenser System using RFID with Water Temperature Controlling for College Hostel" has yielded promising results in addressing the inefficiencies and challenges prevalent in the existing hot water distribution system. Through the integration of RFID technology, users now benefit from secure and personalized access to the hot water dispenser system, mitigating concerns regarding unauthorized usage. Moreover, the incorporation of precise water temperature control has significantly enhanced user satisfaction by allowing individuals to tailor their water temperature preferences, thereby fostering a more comfortable and enjoyable experience. The enforcement of a single-use policy per day per RFID card has not only promoted fair usage but also contributed to energy conservation, aligning with sustainability goals within the college hostel environment.

Furthermore, the successful orchestration of system components through the Arduino microcontroller has facilitated seamless interaction between RFID authentication, temperature control, and policy enforcement. Real-time feedback mechanisms, implemented through display modules, have enhanced user awareness and transparency, ensuring a streamlined and efficient hot water distribution process. Rigorous testing and validation procedures have validated the functionality and reliability of the system, with thorough assessments conducted on RFID card access, temperature control accuracy, and adherence to the single-use policy. Overall, the developed hot water dispenser system represents a significant advancement in promoting user satisfaction, operational efficiency, and sustainability within the college hostel setting.

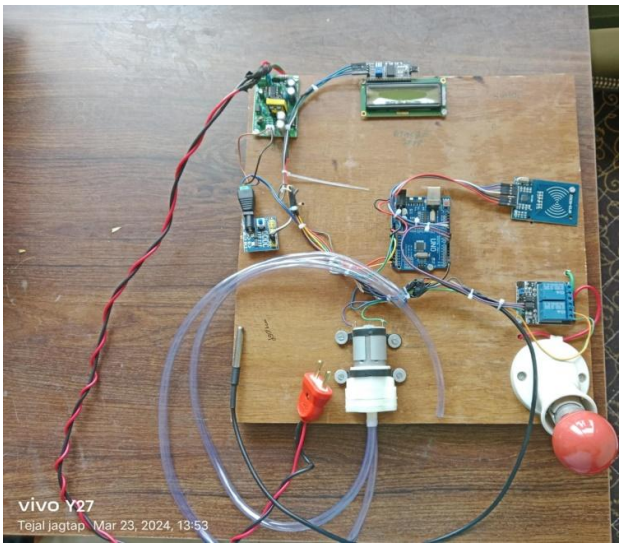

Figure 2: Output of System

V. CONCLUSION

In conclusion, the "Hot Water Dispenser System using RFID with Water Temperature Controlling for College Hostel" offers an innovative solution to streamline hot water distribution. By incorporating RFID technology, temperature control, and a single-use policy, the system enhances security, fairness, and energy efficiency. The use of an Arduino microcontroller ensures seamless operation, while real-time feedback through a display module promotes transparency. While the system brings substantial benefits, considerations for implementation complexity and maintenance are essential. Overall, this project represents a significant step towards leveraging technology for an improved and sustainable hot water dispensing process in college hostels.

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REFERENCES

[1]. Madhumati R, Reshma sultana, Dharshana R, "Smart water ATM in India using cloud model". IEEE 2017
[2]. Aditi Mohan, Niyati Tiwari, Rajdeep Ghosh, Prof.A.A Shinde, "Coin Operated Water Dispenser".ISO 9001:2008 Certified Journal: IEEE, 2017.
[3]. Manish Navlakha, Imran, lokendra Singh Rathore, Luvkush Sharma, "Water Vending Machine".ISSN:2250-0758,ISSN:2394-6962, p.p:581-584©2016
[4]. Roy Want (2006), "An Introduction to RFID Technology" .IEEE press. Pp.25-33
[5]. Pulvirenti, F. Milazzo, P. Ursino, R, Analog and Mixed IC Design, 1997. Proceeding. 1997 2nd IEEE-CAS Region 8 Workshop, 12-13 Sep 1997, Pg. 97 -100
[6]. Anjana S , Sahana M N , Ankith S , K Natarajan , K R Shobha , IEEE ANTS 2015 1570192963
[7]. Pasture, M. Krummenacher, F. Robortella, R. Simon-Vermot, and R. Kayal, M. Ecole Polytech. Feb. De Lausanne, A fully integrated solar battery charger circuits and System and TAISA Conference, 2009. NEWCAS-TAISA '09. Joint IEEE North-East Workshop.
[8]. Eduardo Garcia Breijo, Luis Gil Sanchez, Javier Ibañez Civera, Alvaro Tormos Ferrando, Gema Prats Boluda, "Thick-Film Multisensor for Determining Water QualityParameters" Proceedings of the IEEE, 2002.
[9]. Dunkels, B. Gronvall, T. Voigt, "Contiki - a lightweight and flexible operating system for tiny networked sensors" in Local Computer Networks, 2004. 29th Annual IEEE International Conference on, Nov. 2004, pp. 455-462.
[10]. 1Barth, H. Schaeper, C. Schmidla, T. Nordmann, H. Kiel, M. Van der Broeck, H. Yurdagel, Y. Wieczorek, C. Hecht, F. Saure, D. U., Development of a universal adaptive battery charge As an educational project Power Electronics Specialists Conference, 2008. PESC 2008. IEEE, 15-19 June 2008, Pg 1839-1845