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Water ATM System

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ABSTRACT :

The increasing demand for efficient, secure, and accessible water distribution systems—especially in urban and rural areas with water scarcity—has highlighted the importance of smart water dispensing technologies. Traditional manual water distribution methods often lead to wastage, inefficiencies, and inequitable access. To address these challenges, this project proposes a Smart Water ATM system utilizing Radio-Frequency Identification (RFID) technology for controlled and efficient water dispensing. RFID technology uses electromagnetic fields to automatically identify and authenticate users via RFID cards or tags, enabling secure access to water based on pre-registered credentials. By integrating RFID authentication into the water dispensing unit, the system ensures that only authorized users can draw a specific quantity of water, promoting accountability and minimizing misuse. In this system, an RFID reader scans user cards in real time, verifies user identity, and grants access to water based on preset quotas or payment credits. The microcontroller processes the user data, activates the solenoid valve, and allows water to be dispensed for a fixed volume or duration. Additionally, the system can record usage logs, monitor water levels, and alert for maintenance needs, contributing to operational efficiency and transparency.

Keywords:RFID,Water,ATM,Vending,Dispensing,Automation,Microcontroller,IoT,Embedded,Sensor,Access,Distribution, Management, Contactless

Introduction

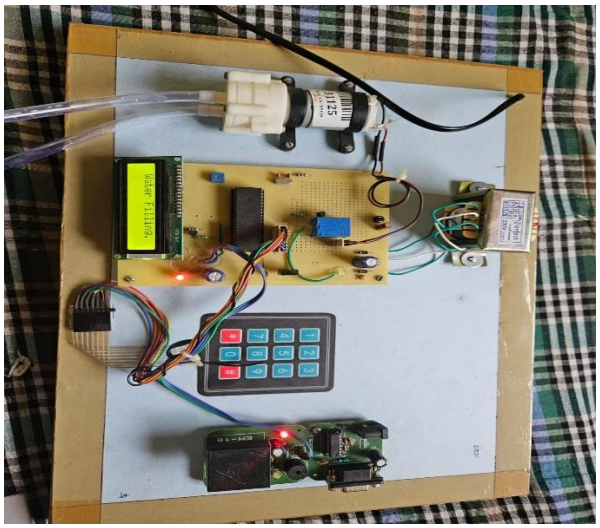
Smart Water ATM systems are increasingly viewed as a sustainable solution to address water scarcity, especially in underserved urban and rural communities. As access to clean and regulated water becomes a growing global concern, advancements in automated dispensing, secure access, and efficient management systems are driving the evolution of public water distribution. Among these, RFID (Radio-Frequency Identification) technology plays a central role in enabling controlled and traceable water access. To ensure equitable water distribution and minimize wastage, various authentication and dispensing techniques are integrated into Water ATM systems. RFID-based access control is a cost-effective and user-friendly method that enables users to access water through RFID-enabled smart cards or tags. This method ensures security, eliminates the need for manual supervision, and allows for prepaid or quota-based dispensing. GSM/GPRS-enabled modules are often added to transmit usage data for monitoring and analytics, further improving accountability and service transparency. The integration of image processing algorithms—such as the Densitometry 3-Channel method for detecting color-specific regions and the Watershed algorithm for boundary segmentation—provides the backbone for automated feature extraction.

RESULT AND DISSCUSION

1. 1.The implementation of the RFID-based Smart Water ATM system was carried out successfully using a combination of hardware components such as the RFID reader, microcontroller (Arduino), solenoid valve, flow sensor, LCD display, and GSM module. After careful integration and programming, the system was tested in various scenarios to evaluate its performance, functionality, and reliability.
2. Upon scanning an authorized RFID tag, the system accurately identified the user and initiated the water dispensing process. The solenoid valve was triggered to open, allowing water to flow through the pipe. The flow sensor successfully measured the quantity of water dispensed and automatically stopped the flow once the pre-set limit was reached. This ensured precise control over water distribution and helped prevent wastage. Users could view real-time information such as water quantity and user balance on the LCD screen, which was clear and responsive.
3. In case of unauthorized RFID tags or cards with insufficient balance, the system denied access to water and displayed appropriate messages. This indicates that the authentication mechanism was reliable and the logic behind RFID tag verification worked effectively.
4. The GSM module was also tested to send SMS alerts in case of specific events like low water levels, maintenance alerts, or system faults. During testing, the module showed consistent performance in transmitting data to the registered administrator's mobile number, which proves useful for remote monitoring and management of the system.
5. From the results, it is evident that the system achieved its primary objective of delivering clean water in a controlled and accountable manner. It offers transparency, resource efficiency, and ease of access in areas facing water scarcity or lacking centralized water supply infrastructure. Additionally, the automation reduced manual intervention, thereby minimizing human error and potential misuse.
6. The response time of the RFID system was within acceptable limits, averaging below one second for user identification. The flow sensor maintained an accuracy of over 95% in measuring the dispensed volume, confirming the system’s practical viability. However, some

limitations were observed during testing under extreme environmental conditions such as high humidity or fluctuating voltage, where the GSM module exhibited minor communication delays.

7. In conclusion, the RFID-based Smart Water ATM system presents a sustainable and technologically viable solution for public water distribution. With further optimization and scalability enhancements, it can be deployed in rural and urban regions alike to promote fair and efficient water usage.



Hardware result Image

CONCLUSION

This project demonstrates the effective use of RFID and automation technologies to ensure secure, efficient, and equitable access to clean drinking water. By integrating RFID-based authentication with real-time monitoring and smart dispensing mechanisms, the system enables user accountability, reduces water wastage, and supports scalable deployment in both urban and rural areas. The smart water ATM is a sustainable and cost-effective solution for addressing water distribution challenges, and it paves the way for future enhancements through IoT integration, cloud analytics, and solar-powered operation.

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