RESEARCH PAPER

Project ID:

Project Title: Designing a Compact Automatic Water Dispenser using RFID and IoT with ESP8266

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a. Introduction

Water conservation and fair distribution are crucial for sustainable living. Traditional water dispensers do not monitor individual usage, leading to wastage and lack of account- ability.

This project will aim to design and test a **compact automatic water dispenser** using ESP8266, RFID authentication, and IoT. Each registered user will have an RFID tag, which when scanned, will dispense a preset quantity of water. IoT connectivity will send usage data to a mobile app or dashboard, ensuring that users receive alerts about their remaining water quota.

b. Selection of Problem and Background Information

Unregulated water usage is a growing issue in schools, offices, and public places. Users often consume more than necessary, and monitoring individual consumption is difficult.

Existing dispensers lack accountability and data-driven management. By integrating RFID authentication and IoT-based alerts, water usage can be tracked, controlled, and optimized for fair distribution and conservation.

c. Objective

Research Problem / Question: How can RFID and IoT integration with ESP8266 ensure controlled, accountable, and fair water dispensing compared to traditional sys- tems?

What will be found out:

- Efficiency of RFID-based authentication in managing user access.
- Accuracy of preset water dispensing control.
- Effectiveness of IoT alerts in monitoring quota and preventing wastage.

Variables:

- Independent Variables: RFID tag ID, preset water quota, dispensing frequency.
- Dependent Variables: Dispensed volume, alert accuracy, user compliance with quota.
- Controlled Variables: Pump flow rate, ESP8266 firmware, water pressure.

Control in the Study: A normal (non-automated) dispenser without RFID or IoT monitoring will be the control for comparison.

d. Hypothesis

If an ESP8266-based RFID and IoT-enabled dispenser is implemented, then water dispensing will be controlled and users will be more accountable, resulting in reduced wastage compared to normal dispensers.

e. Procedure

Design of Study: A compact dispenser will be built with ESP8266 as the controller, RFID for user identification, a water pump/solenoid valve for dispensing, and IoT for data logging and alerts.

Materials Required:

- ESP8266 microcontroller with Wi-Fi.
- RFID reader module (RC522) and RFID tags/cards.
- Solenoid valve or mini water pump.
- Flow sensor to measure dispensed water.
- Water container and piping.
- Buzzer/LED indicators.
- Cloud database / IoT platform (e.g., Firebase, Blynk, or MQTT server).

Stepwise Procedure:

1. Register RFID tags with preset water quotas for users.
2. Connect RFID reader to ESP8266 for authentication.
3. On scanning a valid RFID, solenoid valve/pump will dispense preset water volume.
4. Flow sensor will measure the actual dispensed quantity for accuracy check.
5. ESP8266 will update cloud database with user ID, amount dispensed, and quota remaining.
6. Mobile app or SMS alert will notify the user after each dispense.
7. Trials will be conducted to compare accuracy and efficiency with normal dispenser.

Proposed Data Tables:

Table A: Dispensing Accuracy

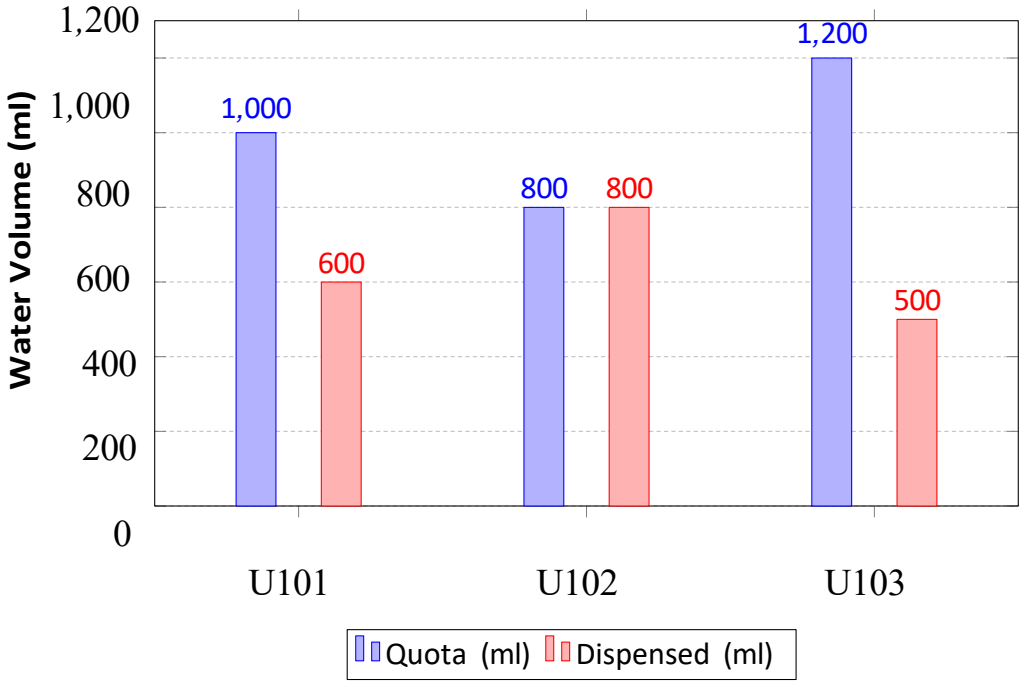
Trial No.	Preset Volume (ml)	Actual Dispensed (ml)	Accuracy (%)
1	200	198	99%
2	300	305	98.3%
3	150	148	98.6%

Table B: Quota Monitoring and Alerts

User ID	Daily Quota (ml)	Dispensed (ml)	Remaining (ml)	Alert Sent
U101	1000	600	400	Yes
U102	800	800	0	Yes
U103	1200	500	700	Yes

Graphical Representation

Water Quota vs Dispensed Volume per User



f. Risk and Safety

- Low-voltage ESP8266 and pump circuit for safety.
- Water leakage prevention using sealed tubing and connectors.
- System tested on small-scale container before large-scale use.

g. Data Analysis

- Dispensing accuracy will be analyzed by comparing preset vs actual volume.
- Quota compliance will be measured by tracking consumption vs assigned quota.
- Alert reliability will be checked by log analysis of notifications sent.
- Graphs will be plotted for volume accuracy and user quota tracking.

REFERENCE

1. Express if Systems. *ESP8266 Technical Reference Manual*.
2. RC522 RFID Module Datasheet and Application Notes.
3. Blynk / Firebase IoT documentation for ESP8266.
4. Singh, P. et al. "IoT-based smart water management systems." *International Jour- nal of IoT Applications*.