Course Title:Internet of Things Lab

Course No: CSE-4264

RFID-ENABLED SMART WATER DISPENSING SYSTEM WITH CARD CONTROL AND LIVE BILLING USAGE TRACKING

RESEARCH PARTICIPANTS

GROUP 04

Saadman Salman Saad
20210104114

Abdullah Al Maruf
20210104116

Sharun Tawsif
20210104124

Nafisa Tabassum Shouty
20210104127

LIST OF CONTENTS

Problem Statement

Project Description

Solution Approach

Key Features

List of Required Equipment

System Diagram or Flowchart

Literature Review

Gap Analysis

Conclusion

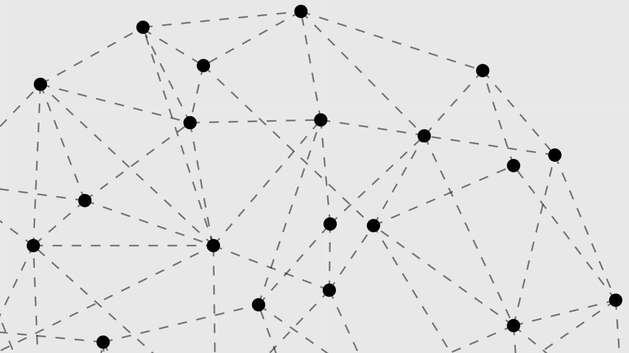
04

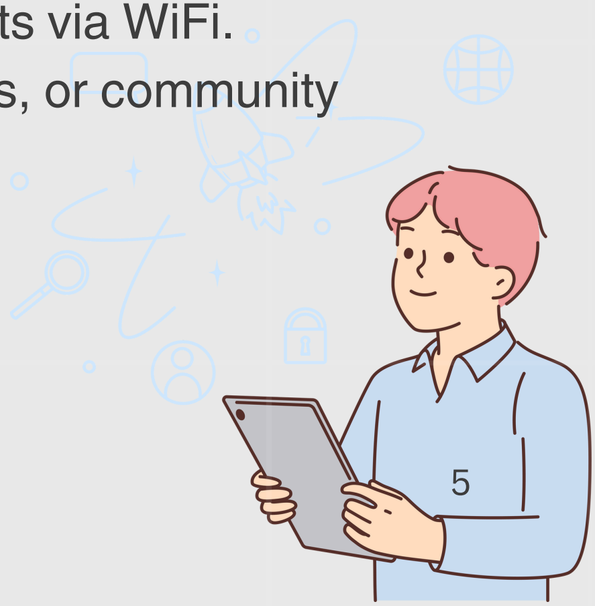
PROBLEM STATEMENT

Sl. No.	Identified Problem
1	Uncontrolled public water usage leads to **wastage and inefficiency**
2	**Manual billing systems** are error-prone and lack transparency
3	**Unauthorized access** to water sources causes unfair usage
4	No **real-time tracking** of individual consumption and cost
5	Lack of **automated systems** for water management in public places
6	Need for a **smart, accountable, and user-based solution** to ensure fair distribution

PROJECT DESCRIPTION

- A smart water dispensing system designed to reduce wastage and ensure fair billing.
- Users authenticate themselves using RFID cards to access water.
- Water flows only while the card is held in place.
- Real-time billing is calculated based on the water used.
- All usage data (volume and cost) is logged automatically to Google Sheets via WiFi.
- Ideal for public water distribution points (e.g., WASA), schools, campuses, or community water stations.

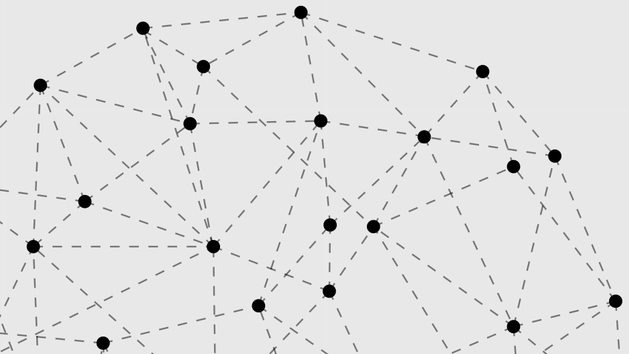




SOLUTION APPROACH

How It Works:

- ESP32 acts as the central controller with built-in WiFi.
- RFID Reader (RDM6300) reads the user's card and validates it.
- Relay Module activates the Water Pump only while the card is present.
- Billing and volume are calculated using time or flow-based logic.
- LCD Display shows real-time usage and billing info to the user.
- Data is automatically sent to Google Sheets for monitoring and billing logs.



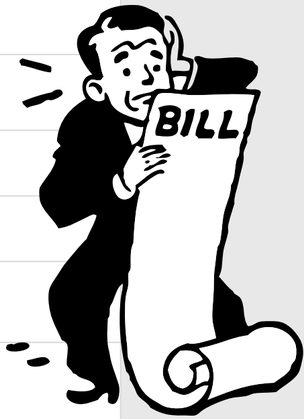
04

KEY FUNCTIONALITIES

- RFID-Based User Authentication
  Only authorized RFID card holders can access the dispenser.
- Smart Water Dispensing
  Water flows only while the RFID card is held near the reader.
- Real-Time Usage Monitoring
  Tracks how much the water is dispensed
- Live Billing Calculation
  Calculates cost based on usage volume.
- LCD Display Feedback
  Shows system status, amount used, and bill during operation.
- Automated Data Logging
  Sends usage and billing data to Google Sheets via WiFi.
- Power Management
  Voltage regulated using buck converter; relay controls high-power pump safely.
- Manual ON/OFF Switch
  System can be turned off manually for maintenance or emergencies.

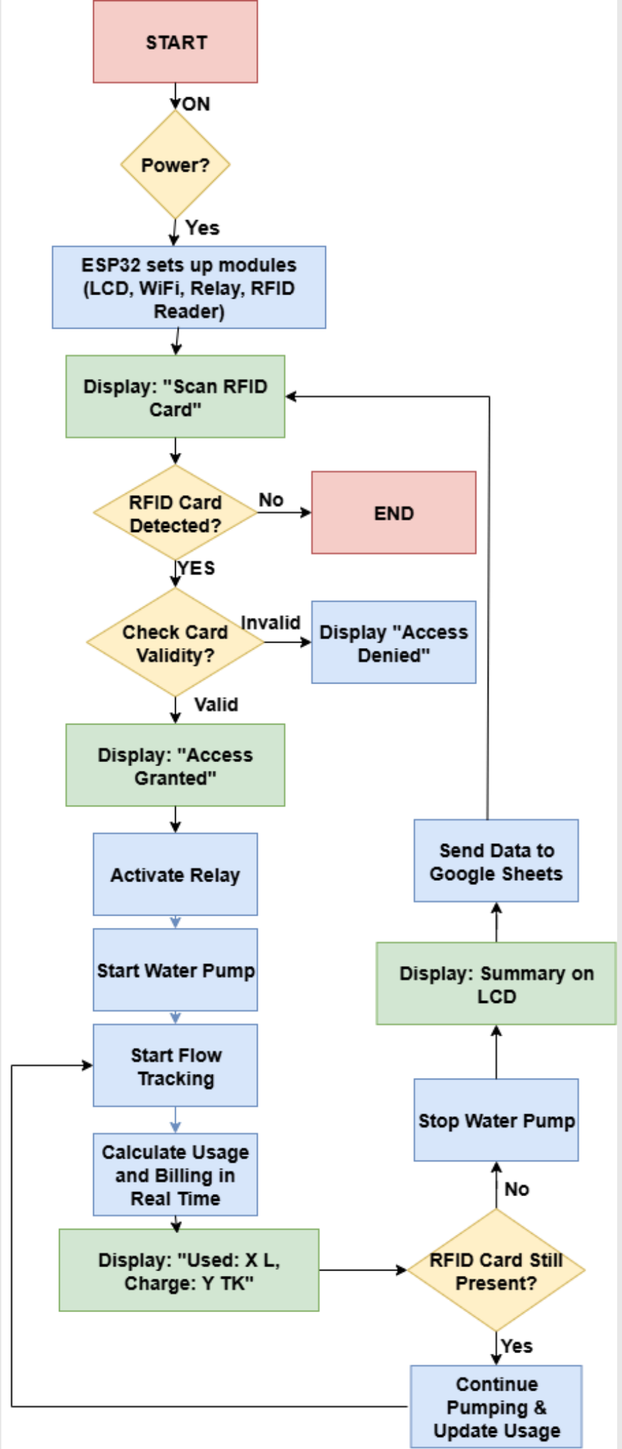
LIST OF REQUIRED EQUIPMENT

Component	Quantity	Unit Price (BDT)	Total Price (BDT)
ESP32 WiFi Development Board	1	✗	✗
RDM6300 RFID Reader	1	415	415
125 kHz RFID Card	1	50	50
16x2 LCD Display	1	240	240
I2C LCD Driver	1	80	80
Water Pump (Mini DC)	1	180	180
Water Pipe (Flexible)	1 meter	40	40
Water Tank	1	300	300
Veroboard	1	60	60
Power Supply Adapter	1	150	150
Battery Case (4xAA)	1	60	60
PVC Board	1	70	70
MP1584 Buck Converter	1	100	100
Power Switch	1	20	20
Female Header Strip	1	30	30
Male Header Strip	1	30	30
Jumper Wire (M-M / M-F / F-F)	1 set	✗	✗
1 Channel 5V Relay Module	1	95	95
Total Cost	✗	✗	1920



PROJECT DETAILED PLAN

using Flowchart and System Diagram



1. System Initialization

- The system powers on via the Power Switch.
- The ESP32 initializes all connected modules:
  - RDM6300 RFID Reader
  - 16x2 LCD Display (via I2C Driver)
  - Relay Module
  - WiFi Connection Setup
- LCD displays: "Scan RFID Card"

2. User Authentication

- User taps or holds the 125 kHz RFID Card near the RDM6300 reader.
- The ESP32 reads the RFID UID and checks authorization (either from a local list or Firebase/Google Sheets).
- If unauthorized, LCD shows "Access Denied" and resets.

3. Start Water Dispensing

- If the card is valid:
  - LCD shows "Access Granted" and starts showing "Water Flowing...".
  - ESP32 activates the 5V Relay, turning on the Water Pump.
  - Water flows through the Water Pipe from the Water Tank.

4. Live Usage & Billing

- A timer or flow sensor tracks how long the pump is active (water flow duration).
- The ESP32 calculates:
  - Volume used (optional: based on time or flow rate calibration)
  - Billing amount (e.g., 1 Litre = X Taka or per second)
- Display updates continuously:
  - "Used: 1.25L"
  - "Bill: 2.50 TK"

5. Stop Dispensing

- When the user removes the RFID card, the ESP32:
  - Deactivates the Relay, stopping the Water Pump.
  - LCD shows "Dispensing Stopped" and summary of usage.

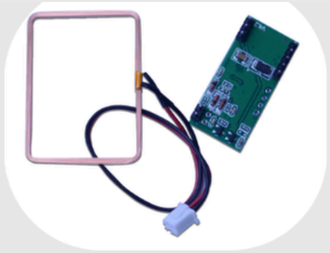
6. Data Upload to Cloud

- The ESP32 sends the data via WiFi to Google Sheets (using Apps Script + HTTPS or integration platforms like IFTTT or Blynk):
  - Card UID
  - Time & date
  - Amount of water dispensed
  - Total charge

7. Ready for Next User

- System resets to "Scan RFID Card" for the next user.
- Process repeats.

RFID Card



RDM6300 RFID Reader

Sends Card ID

ESP32 WiFi Board

show status, billing

=

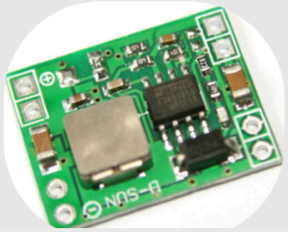
+

16x2 LCD Display
+
I2C LCD Driver

switch ON/OFF

Relay Module (1 Channel 5V)

Water Pipe → Water Outlet



Power Supply
(MP1584 Buck Converter)

Data sent via WiFi

Google Sheets for billing & usage tracking

Power Switch
(manual ON/OFF)

BACKGROUND STUDY / GAP ANALYSIS

05

[1] Instructables – Water Dispenser IoT Project

- Components: ESP8266, RFID Module, Relay, LCD, Pump
- Functionality: RFID triggers pump, shows status on LCD, logs via Blynk
- Specialty: DIY-friendly, easy Wi-Fi setup, basic IoT structure
- **Gap:** No real-time billing or Google Sheets logging; lacks secure ID validation and large-scale tracking

[2] Smart Water ATM (MDPI, Electronics)

- Components: Arduino Uno, RFID Reader, Flow Sensor, Relay, LCD
- Functionality: RFID authentication, flow-based billing, LCD status
- Specialty: Real-time billing with flow rate sensing
- **Gap:** Does not integrate cloud storage like Google Sheets; lacks Wi-Fi automation for updates

[3] RFID + IoT in Water Vending (ResearchGate)

- Components: NodeMCU, RFID, Ultrasonic Sensor, Relay, GSM
- Functionality: RFID access, tank level sensing, alerts via GSM
- Specialty: Combines IoT + water level + GSM alerts
- **Gap:** Focus is more on vending control, not detailed billing or usage-based payment tracking

[4] IJARSCT – IoT Water Management for Rural Areas

- Components: Arduino, RFID, Relay, LCD, Pump
- Functionality: RFID access to enable pump, shows info on LCD
- Specialty: Simplicity for low-tech rural deployment
- • Gap: No billing logic or cloud sync; doesn't track individual usage

[5] Academia – Smart Water Dispenser Using RFID

- Components: Arduino, RFID, IR Sensor, LCD, Pump
- Functionality: RFID activates pump; IR detects cup/glass
- Specialty: Safety mechanism for unattended dispensing
- Gap: No billing/tracking system; system is offline only

BACKGROUND STUDY / GAP ANALYSIS

05

[6] GitHub – Smart Water Dispenser System

• Components: ESP32/Arduino, RFID, Ultrasonic Sensor, Relay
• Functionality: RFID for access, tank level sensing, control logic
• Specialty: Open-source and modular design
• Gap: Lacks billing integration and real-time cloud database

[7] IJCRT – Automatic Water Dispenser Using IoT

• Components: RFID, Arduino, Flow Sensor, Pump, Relay
• Functionality: Dispenses water based on flow time
• Specialty: Simple but effective billing logic
• Gap: No RFID-based user logging or data backup via internet

[8] IJARST – Smart Liquid Dispensing Machine

• Components: RFID, Solenoid Valve, Arduino, LCD
• Functionality: Dispenses set amount after authentication
• Specialty: Precise, fixed-volume dispensing system
• Gap: Does not measure actual usage; lacks billing customization and tracking

[9] IJIRT – Automatic Water Dispenser Using IoT

• Components: Arduino, RFID, Solenoid Valve, Relay, LCD
• Functionality: Dispenses a predefined quantity on RFID scan
• Specialty: Fixed pricing model for community water supply
• Gap: No cloud integration; does not allow dynamic billing based on use

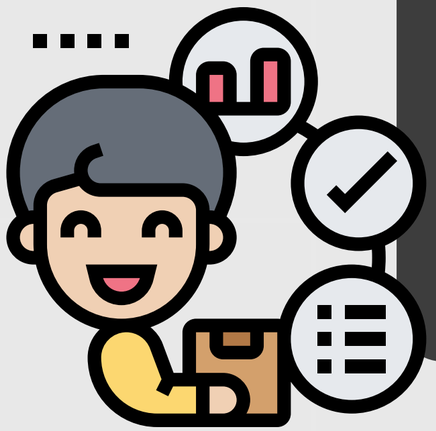
[10] Smart Water Dispenser Monitoring System (Conf. Proc.)

• Components: RFID, Ultrasonic Sensor, WiFi Module, Relay
• Functionality: RFID-based access + water level monitor
• Specialty: Adds monitoring analytics
• Gap: No detailed user billing or integration with billing APIs like Google Sheets

28

CONCLUSION

The RFID-enabled Smart Water Dispensing System offers an innovative, efficient, and accountable solution to modern water distribution challenges. By integrating IoT, automation, and real-time billing, it ensures fair usage, prevents wastage, and promotes digital water management. This system can significantly contribute to sustainable water practices in both urban and rural areas.



REFERENCE

[1] Instructables Team, “Water Dispenser IoT Project,” Instructables, 2024. [Online]. Available: https://www.instructables.com/Water-Dispenser/

[2] K. Abubakar, M. Tariq, and S. R. Ali, “Smart Water ATM with Arduino Integration, RFID Authentication, and Dynamic Dispensing,” Electronics, vol. 13, no. 9, p. 1657, 2024. [Online]. Available: https://www.mdpi.com/2079-9292/13/9/1657

[3] H. Ahmed, “Advancing Water Vending Industry through RFID and IoT Empowerment,” International Conference on Advanced Electrical and Electronics Engineering (ICAEEE), 2024. [Online]. Available: https://www.researchgate.net/publication/381693362

[4] P. Kumari and R. Sinha, “IoT Based Water Management System using RFID for Rural Areas,” International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), vol. 4, no. 5, pp. 123–130, 2024. [Online]. Available: https://ijarsct.co.in/A16820.pdf

[5] N. Jaiswal and R. Jaiswal, “Smart Water Dispenser Using RFID Reader,” Project Report, Academia.edu, 2023. [Online]. Available: https://www.academia.edu/42654070

[6] A. Labrahmi, “Arduino Smart Water Dispenser System,” GitHub Project Repository, 2022. [Online]. Available: https://github.com/Labrahmi/water-dispenser-system

REFERENCE

[7] S. Jain, M. Yadav, and D. Kumar, “Automatic Water Dispenser Using IoT,” International Journal of Creative Research Thoughts (IJCRT), vol. 12, no. 4, pp. 88–91, 2024. [Online]. Available: https://ijcrt.org/papers/IJCRT24A3196.pdf

[8] V. K. Singh, “Design and Construction of a Smart Liquid Dispensing Machine,” International Journal of Advanced Research in Science and Technology (IJARST), vol. 9, no. 2, pp. 55–60, 2023. [Online]. Available: https://www.ijarst.in/public/uploads/paper/951851654145888.pdf

[9] A. Patel, R. Bhatt, and S. Shah, “Automatic Water Dispenser Using IoT,” International Journal of Innovative Research in Technology (IJIRT), vol. 11, no. 3, pp. 112–117, 2024. [Online]. Available: https://ijirt.org/publishedpaper/IJIRT164235_PAPER.pdf

[10] R. Deshmukh and P. Joshi, “Smart Water Dispenser Monitoring System,” International Conference Proceedings on Embedded and IoT Systems, 2020.

ANY QUESTION?