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RFID Based Medicine Vending Machine Using NodeMCU

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Abstract: *The "RFID-Based Medicine Dispenser" project aims to develop an automated and secure system for dispensing medications using RFID (Radio-Frequency Identification) technology. The core components of the system include a NodeMCU microcontroller, an RFID reader, RFID tags, an LCD display, a servo motor and a power supply. The RFID reader scans the unique RFID tags attached to medicine containers, and the NodeMCU processes the data to verify the medication details. Upon successful verification, the servo motor dispenses the medicine and the LCD display provides real time feedback to the user. The system is designed to be user-friendly, secure, and efficient, making it suitable for healthcare facilities, pharmacies. By integrating IoT capabilities through the NodeMCU, the system can also be remotely monitored and controlled, enhancing its functionality and accessibility. This project demonstrates the potential of RFID technology in improving medication management and patient safety.*

Keywords: RFID-Based Medicine Dispenser

I. INTRODUCTION

The RFID-Based Medicine Dispenser Machine is an innovative automated system designed to improve the accuracy and safety of medicine distribution. It uses RFID (Radio Frequency Identification) technology to ensure that only authorized individuals can access and receive the correct medication.

The system includes key components such as an RFID reader (MFRC522), RFID tags, a NodeMCU (ESP8266) microcontroller, an LCD display, and a servo motor (SG90). When a person scans their RFID tag near the reader, the system checks if the tag is valid. If the user is authorized, the machine displays a message on the LCD screen and activates the servo motor to dispense the correct medicine dosage. If the tag is not recognized, access is denied, ensuring medicine safety. This technology greatly reduces human errors that often occur during manual medicine dispensing and provides a more secure and efficient way to manage medication. It is especially useful in hospitals, pharmacies, and home healthcare environments, where proper medication management is critical. By automating the process, the system saves time, enhances patient safety, and ensures that the right medicine is given to the right person.

Research Elaboration Research Background and Motivation

The healthcare industry faces persistent challenges in providing timely and efficient access to essential medicines, especially in rural and remote areas. Traditional pharmacy models often require human presence, are limited by operating hours, and may result in long queues or medicine shortages. To overcome these challenges and improve accessibility, automation in drug dispensing systems has emerged as a promising solution.

One such innovation is the **medicine vending machine**, which functions similarly to food or beverage vending machines but is specifically designed to dispense prescribed drugs. Integrating **RFID (Radio Frequency Identification)** and **IoT (Internet of Things)** technologies offers a secure, smart, and efficient method of medicine distribution.

RFID technology allows for secure user authentication and ensures that only authorized individuals can access the medications. By using RFID tags linked to patient data or prescriptions, this system significantly reduces the chances of misuse or incorrect dispensing of medicines. **NodeMCU**, an open-source IoT platform based on the ESP8266 Wi-Fi

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module, serves as the control unit that manages RFID scanning, cloud communication, and mechanical actuation of the vending unit.

The motivation for this research is rooted in the need to:

Improve **accessibility** to medicines in areas with limited healthcare infrastructure.

Automate the dispensing process to reduce dependency on pharmacists for basic medicine distribution.

Enhance security and accountability through RFID authentication.

Enable **remote monitoring** and **inventory management** using IoT integration.

Provide a **cost-effective** solution for healthcare delivery, especially in underdeveloped regions.

By developing an RFID-based medicine vending machine using NodeMCU, this project aims to contribute to smarter healthcare delivery systems, reduce human error, and increase medication adherence and availability. This solution holds the potential to transform public health services by merging automation, connectivity, and secure access.

Result:

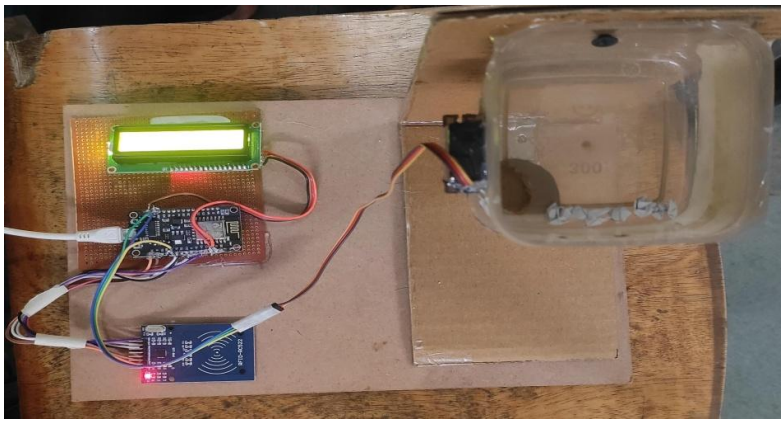

Fig. 1 Hardware of RFID based medicine vending machine

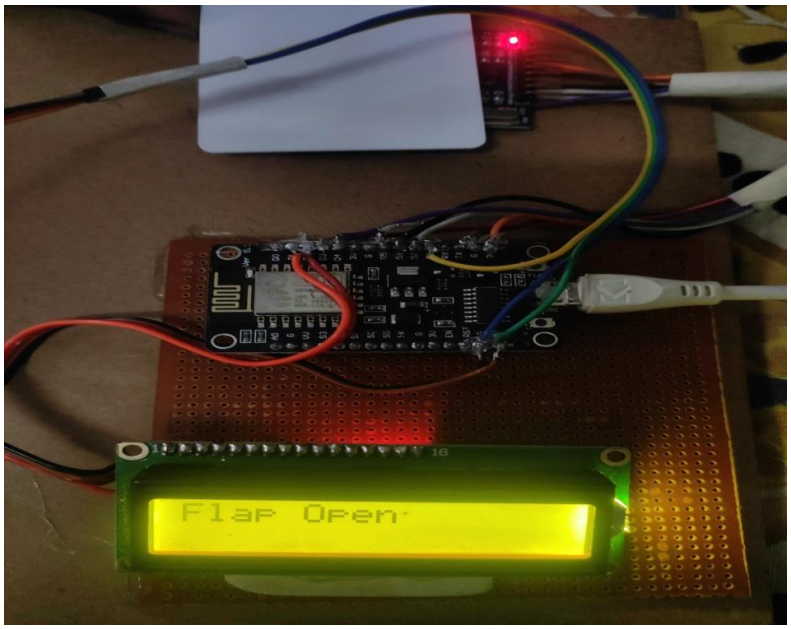

Fig. 2 Reading RFID Tag

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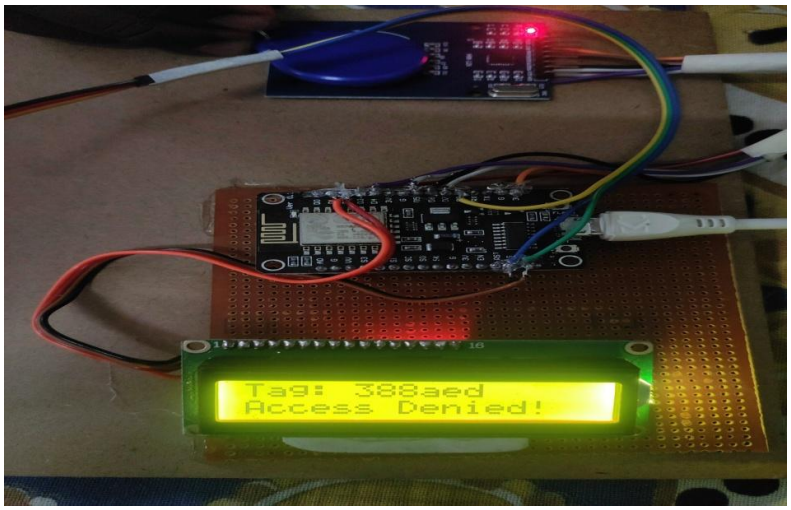

Fig. 3 unregistered Tag

Objectives:

- Design a smart system for automatic medicine dispensing.
- Use RFID for secure medicine authentication.
- Control hardware components using NodeMCU.
- Provide feedback via LCD, LED, and buzzer.
- Enable remote monitoring using IoT.

Algorithms:

Start
Initialize RFID scanner and connect to NodeMCU.
Prompt user to scan their RFID tag.
Read the UID from the RFID Tag.
If UID is valid Dispense the correct medicine.
Else: Deny access.
Long transaction (UID, timestamp, status).
Display message to the user (e.g. “Flap open and Flap close” or “Access Denied”).
End

II. METHODOLOGY

The RFID-based medicine vending machine operates through the integration of hardware components like RFID reader, servo motor, LCD display, and the NodeMCU microcontroller. The core function of the system is to authenticate medicine containers using RFID technology and dispense the correct medication.
System Initialization the NodeMCU initializes all the connected components such as the RFID reader, LCD display, and the servo motor.
RFID Tag Scanning When an RFID tag is brought near the reader, it reads the unique identification (UID) of the tag.
UID Verification the NodeMCU compares the scanned UID with the list of authorized UIDs stored in its memory.
Authentication Result:
If the tag is valid: The system activates the servo motor to dispense the medicine.
If the tag is invalid: No action is taken and an appropriate message is shown on the LCD display.
User Notification the LCD displays relevant messages like “Flap open” “flap close”, or “Access Denied”.

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System Reset After a brief delay, the system returns to standby mode ready for the next RFID scan

Future Scope:

- Integration with cloud-based monitoring.
- Mobile app for notification.
- Medicine refill alerts.
- Fingerprint or facial authentication for enhanced security.

III. CONCLUSION

The developed RFID-based medicine vending machine offers an intelligent and secure solution for modern medication dispensing systems. By integrating RFID technology with a NodeMCU microcontroller, the system ensures that only authenticated RFID tags trigger the dispensing process, reducing the risk of unauthorized access or human error. Its ability to automatically identify users and release pre-assigned medication enhances accuracy and reliability, particularly in healthcare environments such as hospitals, clinics, and remote care settings. Additionally, the use of an LCD display for user feedback improves usability and provides clear guidance throughout the process. Overall, this system addresses critical challenges in medicine management by offering a low-cost, scalable, and efficient alternative to manual distribution.

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