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Team CureCode

PROBLEM STATEMENT

Automatic Drug Dispenser

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ABSTRACT

Transforming Medication Dispensing with Tech Innovation

In an era of digitization and healthcare innovation, the QR Code Drug ATM project stands as a transformative solution to streamline medication dispensing in healthcare facilities. This system combines cutting-edge software and hardware technologies to address long-standing challenges of **patient inconvenience, medication errors, and operational inefficiencies**.

- The heart of the system lies in its advanced software stack, employing **Node.js** for robust backend logic and **React.js** for a seamless user interface. **MongoDB** ensures efficient data management, while **API gateways** facilitate smooth integration with existing healthcare systems. **Python, OpenCV, and machine learning** algorithms provide prescription recognition and security enhancements, guaranteeing precision and accuracy.
- On the hardware front, the system is powered by a **Raspberry Pi** for control and data processing. A **dispenser mechanism**, high-quality **sensors**, and a **QR code scanner** ensure precise medication dispensing and accurate prescription scanning.
- Notably, the project incorporates two **quality control** tools - *Pareto Analysis* and *Risk Management* - to optimize medication selection while safeguarding patient health. This automated approach enhances medication inventory management, user experience, and patient safety.
- What sets the QR Code Drug ATM apart is its ability to operate in multiple **regional languages**, ensuring accessibility to users across diverse linguistic backgrounds. Its **user-friendly** design empowers individuals, including those with limited literacy or from rural farming communities, to navigate and utilize the system precisely.
- Additionally it can be used in the **Private sector** too.

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Introduction

In the pursuit of enhancing healthcare accessibility and streamlining medication dispensing processes, the QR Code Drug Dispensing Machine emerges as a transformative solution. This innovative project is designed to address the challenges faced by patients in healthcare facilities, particularly in rural and remote areas. By seamlessly integrating modern technologies and data-driven approaches, the machine aims to simplify medication management, improve prescription accuracy, and enhance the overall healthcare experience.

Targeted Accessibility: Designed for rural and remote healthcare facilities, addressing limited access to timely and accurate medications.

Empowering Hardware and Software Fusion: Combines hardware components (motors, sensors, user-friendly interface) with advanced software tools to empower both patients and healthcare providers.

Technological Pillars: Utilizes prescription recognition algorithms, machine learning, and quality control tools for accuracy and efficiency.

Comprehensive Healthcare Ecosystem: Enhances capabilities through real-time notifications and data analytics.

Versatile and Adaptable: Customizable, scalable, and adaptable for various healthcare settings.

Comprehensive Report: Provides insights into objectives, features, technology stack, future scope, limitations, and anticipated impact on healthcare accessibility and patient care.

- ★ **Business Applications:** Beyond healthcare, it serves as a solution for secure drug sample distribution for pharmaceutical companies.

Objectives

➤ Awareness:

- To raise awareness about the inefficiencies and risks associated with traditional medication dispensing methods, including **long queues and potential errors**.
- To educate healthcare providers and patients about the benefits of an **automated QR Code Drug Dispensing Machine** in improving healthcare delivery.

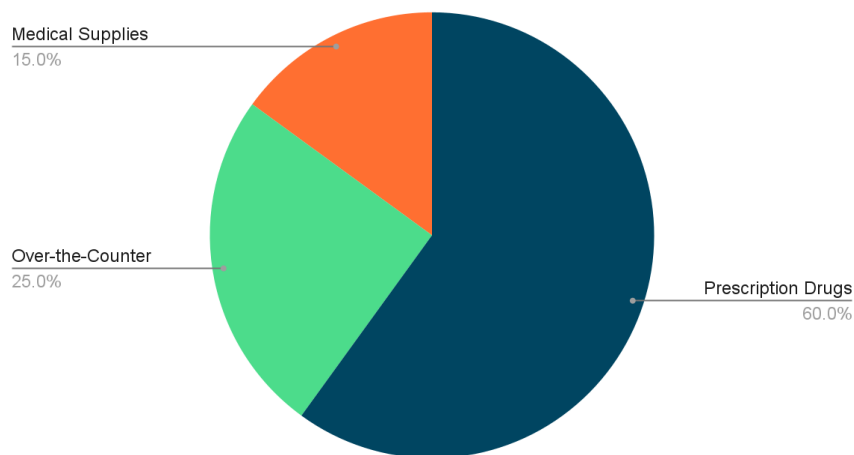
➤ Ease of Use:

- To design the machine with a user-centric approach, ensuring that individuals of varying **education levels** and **technical expertise** can navigate and utilize it effectively.
- To minimize user barriers by providing **multilingual support**, making the system accessible to a diverse population, including those with limited literacy.

➤ Reach:

It has the ability to extend accessible healthcare services to a **wide and diverse population**, particularly those in remote or underserved areas.

Medication Distribution



➤ APPROACH FOR THE SELECTION OF THE MEDICINE TO BE FILLED IN THE MACHINE:

In the process of selecting medicines for dispensing, the QR Code Drug Dispensing Machine incorporates **QUALITY CONTROL TOOLS** to ensure precision and patient safety. Here's how it works:

★ Pareto Analysis:

- Pareto Analysis is utilized to determine which medicines from the **AAYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homoeopathy)** category should be ENTERED in the machine.
- This tool identifies the **top-selling medicines** within the AAYUSH category for a particular government hospital.
- By selecting the highest-selling medicines, the machine ensures that it caters to the most commonly prescribed treatments, optimizing medication availability.

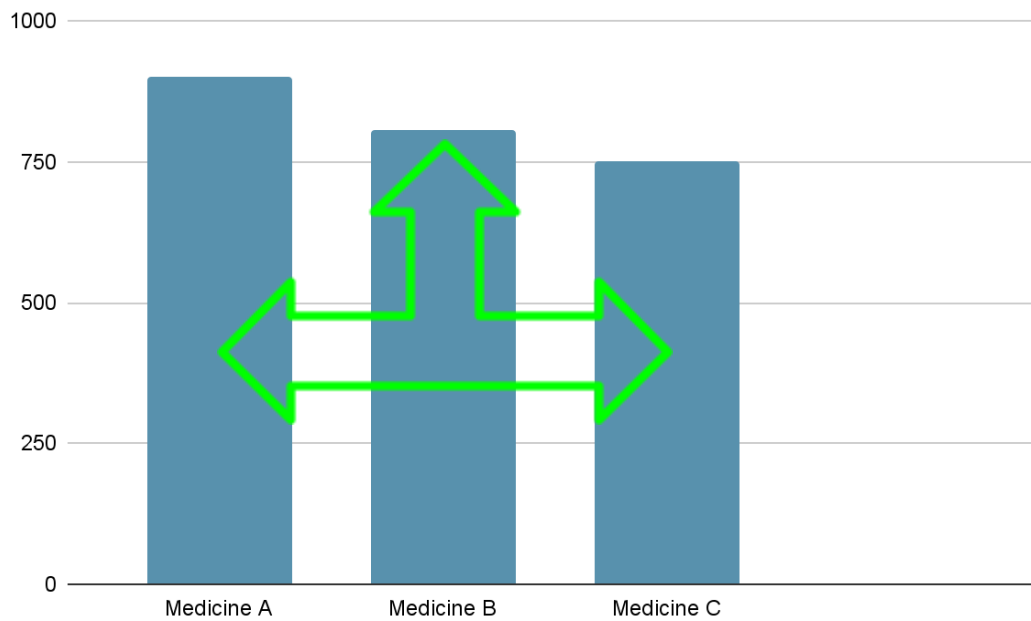
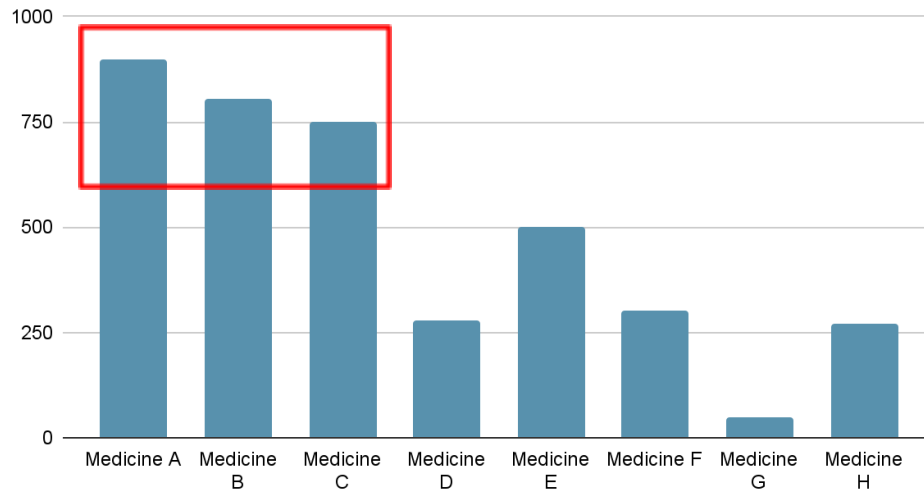
★ Risk Management:

- The system incorporates Risk Management techniques to prevent any potential adverse effects on patients.
- In the event that two medicines are inadvertently exchanged or dispensed incorrectly, the Risk Management tool ensures that such errors do not **compromise patient health**.
- This additional layer of safety guarantees that even in the unlikely event of medicine exchange, patient well-being remains unaffected.

AUTOMATION PROCESS :

1. The QR Code Drug Dispensing Machine employs **data-driven decision-making**. Using Python's **Pandas library** and machine learning algorithms, it analyzes local medicine sales data stored in the hospital's local database.
2. Two QC tools, *Pareto Analysis* and *Risk Management*, are applied to determine which medicines should be stocked in the machine. This approach optimizes medication selection based on sales data, ensuring the availability of the most relevant medicines for patients.
3. **Additionally, the local database is indirectly linked to the Ministry of AYUSH'S main database**, enhancing data accuracy and relevance. This data-driven methodology improves patient care and inventory management.

Sale of Medicine vs Type of Medicine



Conclusion : Medicine A,B,C has Highest Sales and Ensures safe interchangeability of medicines

➤ Private Sector Expansion:

- **Secure Drug Sample Distribution for Pharmaceutical Companies:**

The machine facilitates secure and efficient distribution of drug samples to healthcare professionals on behalf of pharmaceutical companies.

- **Enhanced Customer Experience in Retail Pharmacy Chains:**

Retail pharmacy chains can leverage the machine to provide customers with a streamlined and automated medication dispensing experience.

- **Integration with Telemedicine Platforms for Remote Prescription Fulfillment:**

The system seamlessly integrates with telemedicine platforms, enabling remote prescription fulfillment and medication dispensing, enhancing healthcare accessibility.

- **Subscription-Based Healthcare Services with Regular Medication Refills:**

Private healthcare providers can offer subscription-based services, ensuring regular medication refills for patients with chronic conditions.

- **Data-Driven Inventory Management for Private Pharmacies:**

Private pharmacies can optimize inventory management based on data analytics, reducing costs and improving supply chain efficiency.

These expansion opportunities in the private sector demonstrate the versatility and potential of the QR Code Drug Dispensing Machine in various business scenarios.

Features

1. **Custom Medicine Selection:** Tailored medicine dispensing for specific healthcare facility needs.
2. **Advanced Prescription Recognition:** Precision in recognizing prescriptions for accurate medication dispensing.
3. **Enhanced Security:** Robust security measures for patient data privacy and access control.
4. **Quality Control:** Utilizes Pareto Analysis and Risk Management for precise medicine selection.
5. **Multilingual Accessibility:** Supports regional languages for diverse user populations.
6. **Healthcare Integration:** Links seamlessly with ABHA Health Card and EHR(Electronic Health Records) systems for comprehensive healthcare solutions.
7. **Real-time Notifications:** Provides users with immediate health status updates and medication history.
8. **Battery Reliability:** Operates on a 10-hour rechargeable LiPO battery for uninterrupted service.
9. **Data Analytics:** Aggregates anonymized data for public health research and trend analysis.
10. **Predictive Maintenance:** Uses machine learning for proactive system upkeep.
11. **Affordability Focus:** Ongoing cost optimization to ensure accessibility to various healthcare facilities.
12. **Versatile Deployment:** Suitable for diverse geographic regions and healthcare settings.
13. **User-Friendly Design:** Intuitive interface for users with varying technical proficiency and literacy.
14. **IoT Connectivity:** Integration of IoT for remote monitoring and maintenance.
15. Can be easily used by the **PRIVATE (Business)** sector.

Technologies

Hardware:

- Arduino Mega 2560
- DC Gear Motor (12V, 30rpm)
- L293D Motor Driver
- IR Sensor
- Heat Sink
- LM7805 Voltage Regulator
- HC-05 Bluetooth Module
- Breadboard
- Jumper Wires (Male & Female)
- Power Supply (12V), Rechargeable battery (10 Ah)
- Spiral Spring (size based on medicine specifications)
- Arduino with Raspberry Pi
- & Many More

Software:

- **Node.js:** For robust backend logic.
- **React.js:** For a user-friendly and responsive user interface.
- **MongoDB:** For efficient data management.
- **Python:** For prescription recognition and machine learning algorithms.
- **OpenCV:** For image processing and analysis.
- **Machine Learning (ML):** For prescription interpretation and security enhancements.
- **IoT (Internet of Things):** For connectivity and remote monitoring.
- **API Gateways:** To facilitate integration with healthcare systems.

Process

→ AT THE DOCTOR'S DESK

User Authentication(Diagnosis):

- The end user will be logged in by the doctor using a unique identifier (e.g., **ABHA Health Card**, mobile number) while diagnosing the doctor.
- The system verifies the user's identity and permissions, generates the Prescription with a QR code.

→ AT THE MEDICATION DESK (where our **Problem statement** starts!)

Prescription Recognition:

The end user scans a QR code with the help of a QR code scanner present on the machine. Advanced algorithms analyze and interpret the prescription details.

Medicine Selection:

The system determines the specific medicines to be dispensed based on the prescription data.

Medication Dispensing:

The end user receives a list of prescribed medicines on the machine's user interface.

The machine dispenses the prescribed medicines securely.

Health Status Notification:

Real-time notifications are sent to the end user regarding their health status and recent medication.

Data Integration:

Medication data is integrated with Electronic Health Records (EHR) systems for future reference.

Data Analytics:

Aggregated and anonymized data is used for public health research and trend analysis.

Existing System & why Our's Is Better

Existing Systems:

- There are various drug dispensing machines available in the market, but none of them are specifically tailored for the **Ministry of AYUSH** for rural government hospitals.
- Existing systems lack the capability to analyze the data of AYUSH medicine sales and provide a curated list of medicines to be stocked in the machine.

Why Our Solution/Machine is Better:

- ★ Our QR Code Drug Dispensing Machine is designed to cater specifically to the **Ministry of AYUSH** for rural government hospitals, addressing a critical gap in healthcare infrastructure.
- ★ It utilizes advanced **Python algorithms** for **data analysis**, including reading Excel sheets and employing **quality tools** to determine the exact medicines to be filled in the machine, ensuring precision and accuracy.
- ★ The machine CAN BE seamlessly integrated with the **Ayushman Bharat Health Account (ABHA)** Health Card, providing a comprehensive healthcare solution. ABHA Health Card offers a unique health ID and electronic health records, facilitating accurate patient data management and enhancing the quality of healthcare services.
- ★ Doctors can access these **ELECTRONIC HEALTH RECORDS** for monthly reporting and disease analysis.
- ★ The machine's advanced features include **real-time** health status notifications, providing users with timely information about their health and medication history.
- ★ It operates on a **rechargeable LiPO battery** with a 10-hour capacity, ensuring uninterrupted service even in areas with **unreliable power sources**.

Overall, our solution not only addresses the existing gaps in healthcare but also offers enhanced functionality, data accuracy, and connectivity to improve healthcare delivery in rural government hospitals under the Ministry of AYUSH.

Future Scope

- ★ **Custom Medicine Selection:** Allow healthcare facilities to tailor medicine offerings for specific patient needs.
- ★ **Form Factor Flexibility:** Explore different sizes and designs for versatile deployment.
- ★ **Advanced Algorithms:** Continuously enhance prescription recognition and security using AI.
- ★ **Enhanced Connectivity:** Integrate IoT for remote monitoring and maintenance.
- ★ **User Experience:** Improve user interface for various literacy levels and languages.
- ★ **EHR Integration:** Seamlessly link with Electronic Health Records for data accuracy.
- ★ **Public Health Analytics:** Utilize data for health trend analysis and policy decisions.
- ★ **Predictive Maintenance:** Implement machine learning for proactive upkeep.
- ★ **Cost Optimization:** Focus on affordability for diverse healthcare facilities.

This concise future scope underscores the machine's adaptability and potential for advancing healthcare accessibility and quality.