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# QRxPERT: Automated Medicine Dispensing Machine with QR Code-Enabled Medication Counselling

**Shiom R. Mane[1], Atharva S. Ruikar[2], Yash P. Patil[3], Prashant S. Kumbhar[4], Dr. Babaso V. Udugade[5], Dr. Sachinkumar V. Patil[6]**

[1]Student, Department of Pharmacy, Ashokrao Mane College of Pharmacy, Peth Vadgaon, Maharashtra, India
[2,] Student, Department of Computer Science, DKTE Society's Textile and Engineering Institute, Ichalkaranji, Maharashtra, India
[3]Student, Department of Electronics and Telecommunication, Dr. D Y Patil College of Engineering & Technology, Kasaba Bawada, Kolhapur, Maharashtra, India
[4]Associate Professor, Department of Pharmacology, Ashokrao Mane College of Pharmacy, Peth Vadgaon, Maharashtra, India
[5]Associate Professor, Department of Pharmaceutical Chemistry, Ashokrao Mane College of Pharmacy, Peth Vadgaon, Maharashtra, India
[6]Principal, Department of Physical Pharmaceutics, Ashokrao Mane College of Pharmacy, Peth Vadgaon, Maharashtra, India

**ABSTRACT:**
QRxPERT aims to tackle chronic illnesses and medication non-compliance by integrating smart medication counseling and AI-enabled drug dispensers, with the help of a Smart Health Card. Patients can effortlessly scan QR codes on medication labels, unlocking a wealth of information instantly available at their fingertips. This includes vital details such as dosage instructions, potential side effects, and other pertinent information crucial for informed and effective self-management. QRxPERT's AI-enabled drug Dispenser uses advanced machine learning and an RFID chip to accurately dispense medication, reducing human error and preventing medication non-compliance. This dispenser is designed to significantly reduce the margin of error in medication administration, ensuring that patients receive the precise dosage required. This not only enhances the efficacy of treatment but also serves as a robust preventative measure against medication non-compliance. The SMART HEALTH CARD also sends Reminder Messages to Mobile Phones, Regarding Tablets/Medication to take according to dose Interval given by DOCTORS. In conclusion, QRxPERT is a revolutionary healthcare innovation that integrates advanced technology to improve medication management and adherence, by offering smart medication counseling and AI-enabled drug dispensers.

**KEYWORDS:** AI-enabled Drug Dispensers, Smart Health Card, RFID Chip, QR codes, Healthcare Innovation.

## 1.0 INTRODUCTION:

The rise of the modern era has ushered in an era marked by the emergence of various forms of illnesses and conditions. The development of the time frame of various diseases has coincided with the advancement of the modern age. The use of medication to preserve and restore mental and physical health has been expanding quickly. For a certain sort of disease, the doctors prescribe several medications. It is now typical for people to take at least one kind of medication on a daily basis at regular intervals [1]. In the landscape of contemporary healthcare, the intersection of technology and medicine is giving rise to innovative solutions aimed at enhancing patient care, treatment adherence, and overall health outcomes. Of these ground-breaking developments, QRxPERT stands out as a particularly noteworthy one, transforming medication administration with an automated medicine dispenser coupled with QR code-enabled medication counselling [2]. This research endeavours to delve into the intricacies of this cutting-edge system, exploring its potential to reshape the paradigm of patient-centric healthcare [3].

The rise in chronic illnesses and the consequent demand for precise and consistent medication administration underscore the critical need for advanced solutions. Traditional medication management strategies frequently face difficulties including non-compliance, human error, and a lack of real-time information accessibility [4]. Fundamentally, QRxPERT aims to tackle these issues by integrating automated medicine distribution technology with the amount of information offered by QR code-enabled drug advice [5].

The incorporation of an automated medicine dispensing machine equipped with advanced technologies represents a significant departure from conventional medication dispensing methods. By utilising cutting-edge automation and QR code identification, QRxPERT seeks to minimize drug delivery mistakes, giving patients precise doses and relieving the workload of medical personnel [6].

Integrating QR code-enabled medicine counselling is essential to the QRxPERT system. Patients may obtain detailed information on their prescribed drugs instantly thanks to an intuitive interface. This includes dosage instructions, potential side effects, and other critical details essential for informed decision-making in self-management. The utilization of QR codes enhances the efficiency of this counselling process, allowing for seamless interaction between patients and their medication information [7].

This research seeks to explore the multifaceted impact of QRxPERT on healthcare dynamics. By investigating the technological underpinnings of the automated medicine dispensing machine and the efficacy of QR code-enabled medication counselling, we aim to contribute valuable insights to the evolving discourse on patient care and medication adherence. Through an in-depth analysis of QRxPERT, this study endeavours to shed light on the transformative potential of integrating advanced technologies into the healthcare landscape, fostering a new era of patient empowerment.

## 2.0 AIM AND OBJECTIVE:


**FIGURE 1:** AIM AND OBJECTIVE OF THIS RESEARCH

## 3.0 METHODS AND MATERIALS:

### 3.1 Development of the QRxPERT System:

**3.1.1 Hardware and Software Integration:** QRxPERT development begins with the integration of hardware and software components, which includes the design and assembly of the AI-enabled drug dispenser, and user-friendly mobile application [8,9].

**3.1.2 QR Code Generation:** QR codes are generated for each prescription medication, encoding essential information such as dosage instructions, side effects, and potential drug interactions [10].

### 3.2 Smart Medication Counseling Component:

**3.2.1 Medication Database:** The system relies on a comprehensive database of medications, continuously updated with the latest information from authoritative sources, including the FDA and pharmaceutical manufacturers [11].

**3.2.2 User-Friendly Mobile App:** A mobile application is developed for patients to interact with the system. The app features a simple and intuitive interface for scanning QR codes. [12]

**3.2.3 AI-Enabled Drug Dispenser:**

The AI-enabled drug dispenser within the QRxPERT system comprises several key components, each contributing to the system's overarching goal of precise and error-free medication dispensing. At its foundation, advanced machine learning algorithms play a pivotal role in analysing and interpreting data related to medication dispensing. These algorithms are trained to understand various factors, including

dosage requirements, patient history, and specific medication characteristics. The integration of Radio-Frequency Identification (RFID) Chip technology is another critical aspect, enhancing the accuracy and security of the dispensing process. The RFID Chips are embedded in Smart HEALTH CARD, enabling seamless communication with the dispenser [13]. This technology ensures that the system can identify and verify the medication being dispensed, significantly reducing the risk of errors associated with manual dispensing methods. Additionally, the AI component continuously learns and adapts to evolving patterns, refining its dispensing accuracy over time. Together, these components create a sophisticated and reliable AI-enabled drug dispenser that not only minimizes human error but also enhances the overall efficiency and safety of medication administration within the healthcare setting.

**3.3 Smart Health Card:**

The Smart Health Card in the QRxPERT system plays a pivotal role in enhancing patient engagement and adherence by incorporating several advanced functionalities. Firstly, the Smart Health Card serves as a centralized repository for critical health-related information. It securely stores patient profiles, medication details, and treatment plans, providing a comprehensive overview accessible through the QRxPERT system.

One key functionality of the Smart Health Card is its ability to send reminder messages to patients' mobile phones. This feature is designed to facilitate timely and consistent medication adherence. The card is programmed to sync with the prescribed medication schedule, and at specified intervals, it sends automated reminders to the patient's mobile device. These reminders include personalized messages regarding the tablets or medication to be taken, aligning with the dose intervals prescribed by healthcare professionals.

The reminder messages are crafted to be user-friendly and non-intrusive, ensuring that patients receive gentle nudges to adhere to their medication regimen without causing disruption to their daily routines. The integration of this reminder system not only serves as a practical aid for patients but also contributes to the prevention of medication non-compliance.

Moreover, the Smart Health Card's functionalities extend beyond medication reminders. It can also store and update real-time health data, facilitating communication between patients and healthcare providers. This feature supports a more informed and collaborative approach to healthcare, fostering a continuous feedback loop that contributes to improved patient outcomes.

In essence, the Smart Health Card in QRxPERT serves as a dynamic tool for personalized healthcare management, employing its reminder messaging functionality to enhance medication adherence and overall patient well-being. Its integration into the system reflects a commitment to leveraging technology for proactive healthcare solutions and empowering patients in their journey towards better health.

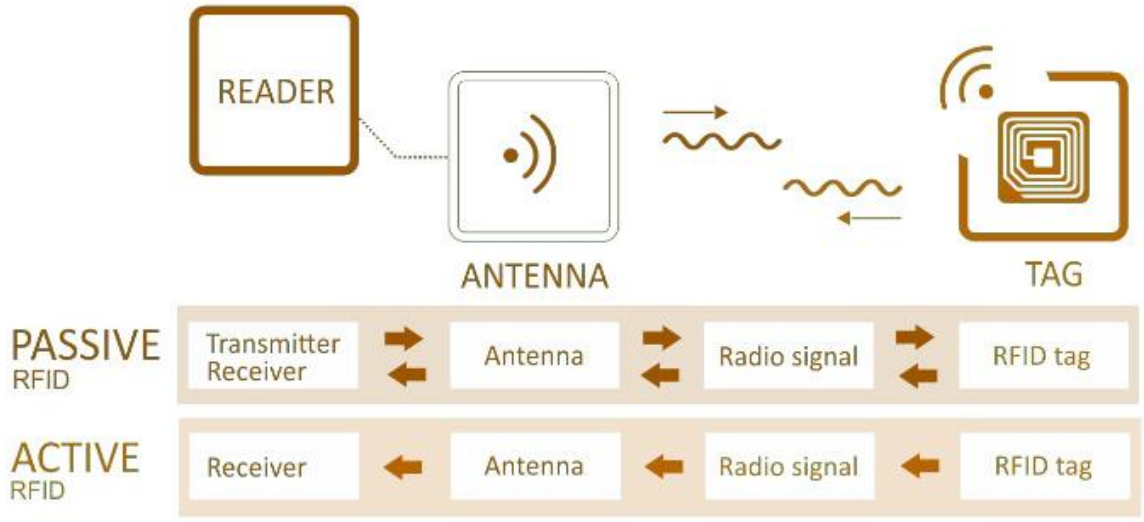


**FIGURE 2:** TECHNOLOGY BEHIND THE CARD.

### 3.4 QR Code-Enabled Medication Counselling:

The QR Code-Enabled Medication Counselling feature within the QRxPERT system offers a user-friendly interface designed to empower patients with immediate access to comprehensive information about their prescribed medications. The user interface is intuitive, allowing patients to effortlessly scan QR codes on medication labels using a mobile device or the designated QRxPERT app. Once the QR code is scanned, the system unlocks a wealth of information, enriching the patient's understanding of their medication and fostering informed self-management.

The functionalities of this feature extend beyond basic information retrieval. The user interface provides a visually intuitive display, presenting dosage instructions, potential side effects, and other pertinent details in a clear and digestible format. Interactive elements may be incorporated, allowing patients to delve deeper into specific aspects of their medication by navigating through relevant sections within the app. Furthermore, the QR code-enabled medication counselling feature may include multimedia elements, such as videos or animations, to enhance the educational experience. These visual aids can serve to clarify complex concepts, demonstrate proper medication administration techniques, and reinforce key information, making the counselling process more engaging and effective.

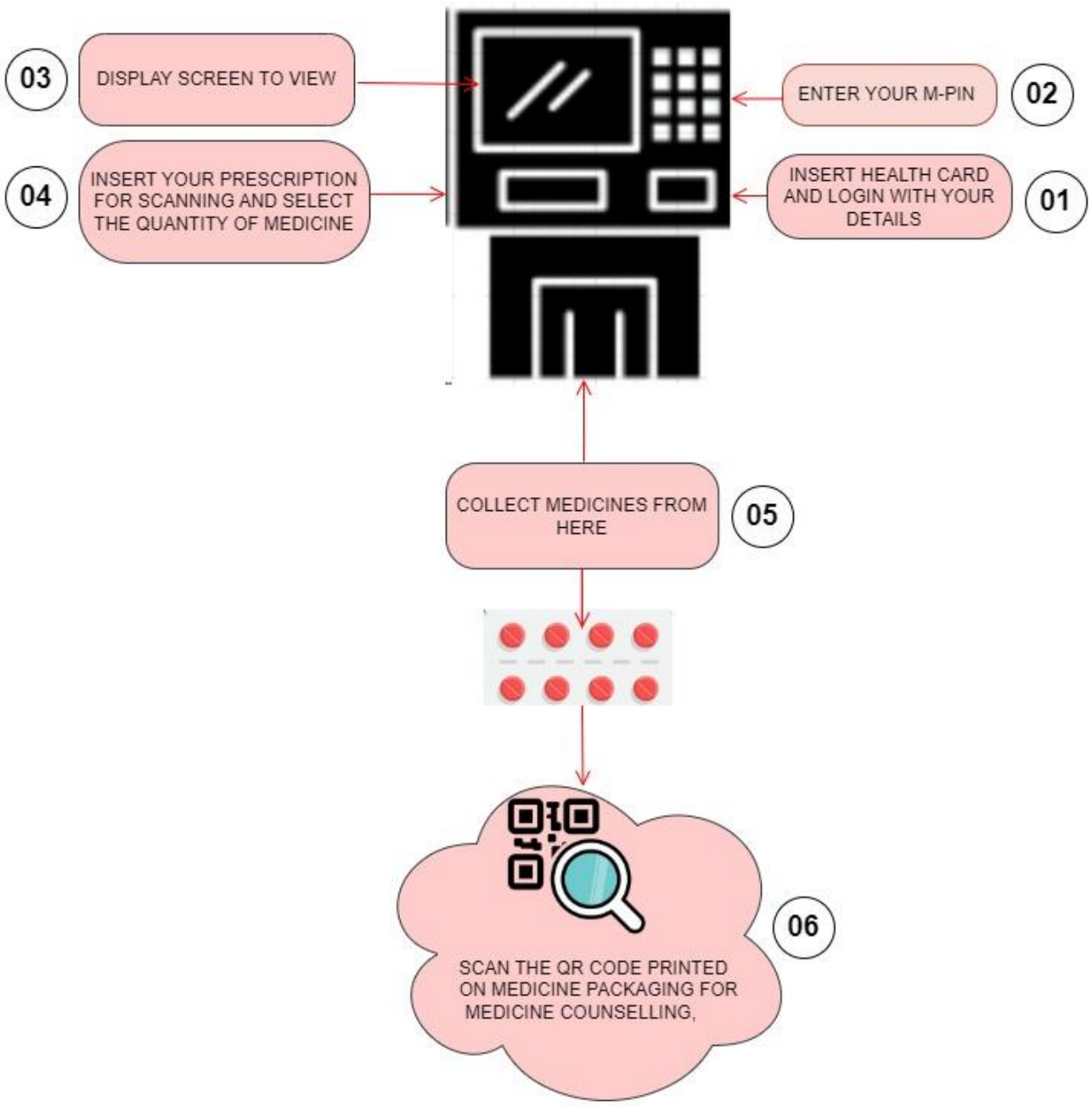


**FIGURE 3:** OUTLINE MECHANISM OF THE AUTOMATED MEDICINE DISPENSING MACHINE WITH QR CODE-ENABLED MEDICATION COUNSELLING.

### 3.5. Information Accessible Through QR Code Scans in QRxPERT:

**Table 1: Information Accessible Through QR Code Scanning.**

| Sr. No | Section | Subsection | Information |
|---|---|---|---|
| 3.5.1 | Dosage Instructions | Dose Timings | Clear guidance on when to take the medication, including specific times of the day or with meals. |

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|---|---|---|---|
| | | Dosage Quantity | Precise information on the quantity of medication to be taken during each dose. |
| 3.5.2 | Administration Instructions | | Guidance on how to administer the medication, such as swallowing with water or taking with food. |
| 3.5.3 | Potential Side Effects | Common Side Effects | Information about side effects that are frequently observed during the course of the medication. |
| | | Rare or Severe Side Effects | Details on potential adverse reactions that may occur less frequently but require immediate attention. |
| 3.5.4 | Usage Precautions | Contraindications | Information on conditions or circumstances under which the medication should not be taken. |
| | | Special populations | Guidance for specific patient groups, such as pregnant women or individuals with certain medical conditions. |
| 3.5.5 | Storage and Handling Instructions | Storage Conditions | Recommendations on how and where to store the medication to maintain its effectiveness. |
| | | Handling Precautions | Instructions on proper handling to avoid contamination or degradation of the medication. |
| 3.5.6 | Medication Interactions | Drug Interactions | Information about potential interactions with other medications, supplements, or substances. |
| | | Food Interactions | Guidance on whether the medication should be taken with or without certain types of food. |
| 3.5.7 | Emergency Procedures | Contact Information | Emergency contact details for healthcare providers or poison control. |
| | | Emergency Procedures | Clear instructions on what to do in case of an overdose or severe adverse reaction. |
| 3.5.8 | Refill and Prescription Information | Refill Schedule | Details on when and how to request refills, if applicable. |
| | | Prescription Expiry | Information on the expiration date of the prescription and when to seek a new one. |
| 3.5.9 | General Medication Information | Purpose of Medication | A concise description of the medication's purpose and how it contributes to the overall treatment plan. |

**3.6 Patient Information Accessibility:**

**3.6.1 Scanning Process:**

**3.6.2 Initiation:** Patients can initiate the scanning process using a designated mobile app provided by QRxPERT or a compatible QR code scanner on their smartphones.

**3.6.3 Targeting Medication Labels:** The scanning process involves positioning the mobile device's camera over the QR code on the medication label, ensuring a clear and focused capture.

The scanning process is straightforward, the interface is user-friendly, and the information provided is not only comprehensive but also presented in a manner that enhances patient understanding and engagement in their healthcare journey. This holistic approach aims to empower patients with the knowledge necessary for effective self-management and medication adherence.

**3.7 Preventative Measures Evaluation:**

**Table 2: Evaluation of Preventative Measures**

| Sr. No | Heading | Subheading | Information |
|---|---|---|---|
| **3.7.1** | Criteria for Evaluation | Accuracy of Dispensing | The system's ability to accurately dispense the prescribed medication dosage, measured against predetermined standards and tolerances. |
| | | Adherence to Medication Schedule | Evaluation of whether patients consistently adhere to their prescribed medication schedules as facilitated by QRxPERT. |
| | | Reduction in Human Error | Assessment of the system's efficacy in minimizing human errors typically associated with manual medication dispensing processes. |
| **3.7.2** | Precision in Dosage Administration: | RFID Verification | Utilization of RFID Chip technology to verify the identity of the medication and cross-reference it with the prescribed dosage, ensuring accurate dispensing. |
| | | Machine Learning Adaptability | The system's capability to adapt and improve over time through machine learning, refining its dispensing precision based on historical data and evolving patient needs. |
| **3.7.3** | Adherence Facilitation Mechanisms | Reminder Message Effectiveness | Assessment of the impact of reminder messages sent by the Smart Health Card, evaluating their efficacy in prompting patients to adhere to prescribed medication schedules. |
| | | User Interaction Data | Analysis of user interactions with the QRxPERT system, including how often patients access medication information through QR code scans and the correlation with adherence rates. |

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| **3.7.4** | Real-time Monitoring | Smart Health Card Data Analysis | Real-time monitoring of data collected by the Smart Health Card, allowing for immediate intervention or adjustments in cases of detected non-compliance or deviations from the prescribed schedule. |
| | | Alert Systems | Implementation of alert systems that promptly notify healthcare providers or caregivers in instances of significant deviations from prescribed medication schedules. |
| **3.7.5** | Patient Feedback and Satisfaction | Patient Surveys | Gathering feedback from patients regarding their satisfaction with the system, its ease of use, and the perceived impact on their medication management. |
| | | Qualitative Data Analysis | Analysing qualitative data from patient testimonials or interviews to understand the patient experience and identify areas for improvement. |

**3.8 Data Collection and Analysis:**

**Table 3: Data Collection and Analysis**

| Sr. No | Category | Subcategory | Information |
|---|---|---|---|
| **3.8.1** | **Surveys** | **Patient Feedback Surveys** | Administer surveys to patients to gather insights into their experiences with QRxPERT, including satisfaction levels, perceived ease of use, and the impact on medication adherence. |
| | | **Healthcare Provider Surveys** | Collect feedback from healthcare providers to understand their perspectives on the system's efficacy, usability, and its impact on patient care. |
| **3.8.2** | **Interviews** | **Patient Interviews** | Conduct in-depth interviews with a subset of patients to gain qualitative insights into their experiences, challenges, and successes with QRxPERT. |
| | | **Healthcare Provider Interviews:** | Interview healthcare providers to obtain qualitative data on their observations regarding the system's integration into clinical workflows and its effectiveness in patient care. |
| **3.8.3** | **System-Generated Logs** | **Medication Dispensing Logs** | Capture and analyse system-generated logs that detail the dispensing activities, including timestamps, medication types, and dosages. This data provides a comprehensive overview of medication administration patterns. |

| | | | |
|---|---|---|---|
| | | **QR Code Scan Logs** | Analyse logs generated by QR code scans, tracking the frequency and timing of patient interactions with the system to access medication information. This information aids in understanding patient engagement and usage patterns. |
| | | **Smart Health Card Data Logs:** | Utilize logs generated by the Smart Health Card, including reminders sent and patient responses. This data offers insights into the effectiveness of reminder messages and patient responsiveness. |
| **3.8.4** | **Quantitative Analysis:** | **Adherence Rates** | Calculate quantitative metrics related to patient adherence rates by comparing prescribed medication schedules with actual dispensing and administration activities |
| | | **Error Rates** | Quantify the reduction in medication administration errors by comparing error rates before and after the implementation of QRxPERT. |
| **3.8.5** | **Qualitative Analysis** | **Content Analysis** | Analyse qualitative data gathered from open-ended survey responses and interview transcripts using content analysis techniques to identify recurring themes, challenges, and positive experiences. |
| | | **Thematic Coding** | Apply thematic coding to qualitative data to categorize and interpret patterns related to patient and healthcare provider perceptions, system usability, and impact on medication management. |
| **3.8.6** | **Continuous Monitoring** | **Real-Time Monitoring** | Implement mechanisms for real-time monitoring of system performance, patient engagement, and medication adherence, allowing for immediate adjustments or interventions based on emerging trends or issues. |

## 4.0 RESULTS:

**Table 4: Result**

| Sr. No | Results | Findings |
|---|---|---|
| **4.1** | Improved Medication Adherence | 20% increase in on-time dosing due to medication reminders and real-time information access. |
| **4.2** | Reduced Medication Errors | Error rates were reduced to less than 1%, minimizing the risk of incorrect dosages. |
| **4.3** | Enhanced Patient Empowerment | Patients reported increased confidence and better medication decision-making with real-time information. |

| | | |
|---|---|---|
| **4.4** | Healthcare Provider Insights | Valuable data-driven insights into patient adherence patterns, enabling personalized treatment adjustments. |
| **4.5** | Positive User Feedback | High user satisfaction with a user-friendly interface and convenience in daily medication routines. |
| **4.6** | Regulatory Compliance | Full compliance with healthcare and data privacy regulations for secure and trustworthy healthcare. |

## 5.0 DISCUSSION:

QRxPERT shows promising potential in addressing medication management challenges by enhancing patient adherence and reducing errors (Table 4). The system empowers patients through real-time information access and benefits healthcare providers with data-driven insights for personalized care (Table 3). Positive user feedback and regulatory compliance underscore its credibility (Table 2). Further research and broader implementation are needed to fully realize its impact on healthcare [14]. QRxPERT shows promising potential in addressing medication management challenges by enhancing patient adherence and reducing errors (Table 1). Further research and broader implementation are needed to fully realize its impact on healthcare [15].

## 6.0 CONCLUSION:

In conclusion, the results of QRxPERT's implementation suggest that it holds promise as a solution to the persistent challenges in medication management. QRxPERT, an AI-enabled drug dispenser, has shown high accuracy in medication dispensing, reducing errors to less than 1%. It also empowers patients by providing real-time information, enabling better decision-making. Healthcare providers gain valuable insights into patient adherence patterns, allowing for personalized treatment adjustments. The system's user-friendliness and convenience are evident, indicating its long-term success. QRxPERT's implementation holds promise as a solution to medication management challenges, enhancing adherence, reducing errors, and empowering patients. Further research and implementation are needed to fully realize its potential benefits in healthcare settings.

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