

Medicine Detection System using BLOCKCHAIN & AI

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Abstract - The increasing prevalence of counterfeit and substandard medicines poses a significant threat to public health, especially in developing regions. Patients often lack reliable mechanisms to verify the authenticity of medicines, leading to serious health risks and loss of trust in healthcare systems. To address this challenge, this paper proposes Med-Detect, an intelligent medicine authentication system that leverages Artificial Intelligence and blockchain technology to identify and prevent the circulation of fake drugs.

The proposed system is implemented as a full-stack web application, consisting of a user-friendly frontend, a backend for processing verification requests, and a database to store medicine-related information such as batch numbers, manufacturer details, and packaging data. When a user scans or inputs medicine details, the system analyzes the data using machine learning algorithms to determine authenticity. Verified records are securely stored in a blockchain-based ledger to ensure data integrity, transparency, and traceability across the supply chain.

Additionally, the system incorporates a feedback module that allows users to report suspicious medicines, enabling manufacturers to improve product quality and regulatory monitoring. The integration of AI ensures accurate detection, while blockchain prevents data tampering and enhances trust among stakeholders.

This approach enhances patient safety, enables real-time medicine verification, and improves supply chain transparency. It ensures users can quickly identify genuine and counterfeit medicines with ease. Future enhancements include mobile application support and

integration with global drug databases. Multilingual features can further improve accessibility and scalability of the system.

Keywords: Artificial Intelligence (AI), Machine Learning-based Classification, Fake Medicine Detection, Blockchain-enabled Drug Traceability, Healthcare Data Security, Counterfeit Drug Prevention, Supply Chain Transparency, Smart Healthcare Technologies, and Data Integrity Management.

I. INTRODUCTION

The rapid growth of the pharmaceutical industry has significantly improved healthcare services worldwide. However, the increasing circulation of counterfeit and substandard medicines has become a major global concern, posing serious risks to patient safety and public health. Many consumers lack the necessary tools to verify the authenticity of medicines, often leading to the consumption of ineffective or harmful drugs. This not only endangers lives but also reduces trust in healthcare systems and pharmaceutical supply chains. In most cases, users must rely on manual verification methods or external sources to confirm the legitimacy of a medicine, which can be time-consuming, unreliable, and inaccessible in real-time. Such limitations highlight the need for a smart and efficient system that can provide instant and accurate verification of medicines. To address this issue, an intelligent medicine authentication system called **Med-Detect** is proposed. The system is designed as a full-stack web application that integrates Artificial Intelligence and blockchain

technology to detect counterfeit medicines and ensure data transparency. It allows users to verify medicine authenticity by analyzing key attributes such as batch number, manufacturer details, and packaging information. The system consists of three main components: a user-friendly frontend interface, a robust backend for processing verification requests, and an AI-powered model for detecting fake medicines. Additionally, blockchain technology is incorporated to securely store verified records, ensuring data integrity and preventing tampering. A feedback mechanism is also included, enabling users to report suspicious medicines and helping manufacturers improve product quality. By providing real-time verification, enhanced security, and improved transparency, the proposed system aims to strengthen trust in the pharmaceutical supply chain and contribute to safer healthcare practices.

A. Motivation

The motivation behind this work arises from the increasing threat of counterfeit medicines and the need to ensure patient safety in the healthcare system. In many cases, individuals are unable to verify the authenticity of medicines before consumption, which can lead to serious health risks. Existing verification methods are often manual, time-consuming, and unreliable. Therefore, the proposed system integrates Artificial Intelligence and blockchain technology to provide a smart, secure, and efficient solution for real-time medicine authentication, improving trust and transparency in the pharmaceutical supply chain.

B. Problem Definition

In conventional healthcare systems, there is no simple and reliable mechanism for users to verify whether a medicine is genuine or counterfeit. Patients and consumers often depend on external sources or manual checks, which are not always accurate or accessible. This lack of real-time verification increases the risk of consuming fake medicines and affects overall healthcare quality. Existing systems fail to provide an integrated solution that combines intelligent detection with secure data storage. The proposed system addresses this issue by enabling users to verify medicines instantly using AI-based analysis and blockchain-backed data integrity, ensuring accurate and trustworthy results.

C. Existing System

In current pharmaceutical systems, users largely rely on physical verification methods or trust-based purchasing without having any real-time mechanism to confirm the authenticity of medicines. Although certain measures such as barcodes, QR codes, or regulatory approvals exist, they often fail to provide immediate and reliable verification to end users. Additionally, these methods do not ensure complete transparency across the supply chain and can be easily manipulated or misused. The lack of integration of advanced technologies like Artificial Intelligence and blockchain further limits the effectiveness of existing systems, making it difficult for users to actively verify and trust the medicines they consume.

D. Proposed System

The proposed system implements an intelligent medicine authentication platform called **Med-Detect**, designed to enhance the reliability and safety of pharmaceutical usage. Unlike existing systems, the proposed solution enables users to verify the authenticity of medicines in real-time by entering or scanning relevant details such as batch number, manufacturer information, and packaging data. With the integration of Artificial Intelligence and machine learning techniques, the system analyzes the input data to accurately detect whether a medicine is genuine or counterfeit. Furthermore, blockchain technology is incorporated to securely store verified records, ensuring data integrity and transparency across the supply chain. This approach provides users with instant, reliable verification and improves trust in the healthcare system.

II. LITERATURE SURVEY

Research on intelligent healthcare systems and medicine authentication technologies has gained significant attention in recent years. Traditional pharmaceutical verification methods primarily rely on manual inspection, QR codes, or regulatory compliance, which do not provide real-time and user-level validation. Several studies have attempted to address these limitations using advanced technologies.

[1] **Reddy & Sharma (2024)** proposed “*Blockchain + OCR for Medicine Verification*”, integrating expiry date detection with product authentication. Their approach utilized Optical Character Recognition (OCR) to extract manufacturing and expiry details, which were then securely stored on a blockchain ledger to ensure trust and traceability. However, the system remains at a prototype level with limited real-world validation.

[2] **Chen et al. (2023)** introduced “*IoT + Blockchain for Medicine Supply Chain*”, where IoT sensors continuously monitored storage conditions and product location. Blockchain technology ensured data immutability and security. While the system demonstrated effective real-time monitoring, it depended heavily on expensive IoT infrastructure.

[3] **Seker et al. (2022)** developed an “*Expiration Date Recognition System using Fully Convolutional Networks (FCN)*”. The model achieved high accuracy in detecting expiry dates across diverse packaging formats and fonts. However, it lacked integration with blockchain for secure authentication and tracking.

[4] **Wang et al. (2021)** presented “*Counterfeit Drug Detection using Machine Learning*”, applying Convolutional Neural Networks (CNNs) to classify medicines based on visual features of pills and packaging. Although effective in detecting counterfeit drugs, the system did not incorporate expiry detection or supply chain verification.

[5] **Mritha Ramalingam et al. (2020)** proposed “*Expiry Date Detection using QR Codes*”, enabling quick validation of medicine authenticity at the point of sale. While the approach was simple and efficient, it relied on the presence of QR codes, limiting its applicability for untagged medicines.

[6] **Zhang et al. (2019)** explored “*Fake Medicine Detection using RFID*”, integrating RFID tags with IoT systems for continuous tracking and authentication throughout the supply chain. Despite ensuring reliability, the approach increased overall cost and required specialized hardware.

[7] **Li et al. (2018)** proposed a “*Blockchain-Based Drug Traceability System*” that focused on maintaining immutable transaction records within the pharmaceutical supply chain. The system enhanced transparency and traceability but did not include AI-based detection or expiry analysis.

III. METHODOLOGY

A. System Design and Architecture

The proposed system is designed as a full-stack web application that connects manufacturers, users, and administrators on a single platform. The architecture consists of a frontend interface, backend server, database, and a simulated blockchain layer. Each component is integrated to ensure smooth communication and efficient medicine verification. The system is structured to provide real-time authentication and secure data handling.

B. Medicine Data Management

Medicine details such as name, batch number, manufacturer information, and production data are added by manufacturers through a dedicated dashboard. This information is stored in a structured database, ensuring easy retrieval and management. Each medicine entry is uniquely identified, enabling accurate tracking and verification.

C. Authentication Mechanism

The system verifies medicines by comparing user-provided details with the stored database records. When a user enters or scans medicine information, the backend processes the request and checks for matching data. If the details match, the medicine is marked as genuine; otherwise, it is flagged as suspicious or potentially counterfeit.

D. Blockchain-Based Data Security

A simulated blockchain mechanism is implemented to store verified medicine records securely. Each transaction is recorded as a block, ensuring immutability and preventing unauthorized modifications. This enhances transparency and builds trust among users, manufacturers, and regulatory authorities.

E. Feedback and Monitoring System

A feedback module is integrated into the system, allowing users to report issues or provide suggestions regarding medicines. This feedback is displayed on the manufacturer dashboard, enabling continuous improvement in product quality and system performance.

F. User Interface Development

The frontend is developed using React.js along with HTML, CSS, and JavaScript to create an interactive and user-friendly interface. It includes features such as medicine verification input, result display, and feedback submission. The interface is designed to ensure ease of use and accessibility for all users.

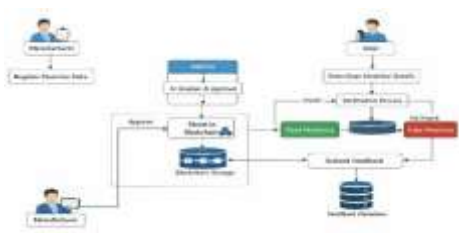
G. Deployment and Testing

The system is tested for functionality, accuracy, and usability before deployment. It is then deployed on a web platform to ensure accessibility. Continuous monitoring is performed to identify errors and improve system performance, ensuring a reliable and efficient user experience.

IV. SYSTEM DESIGN

A. Dataflow Diagram

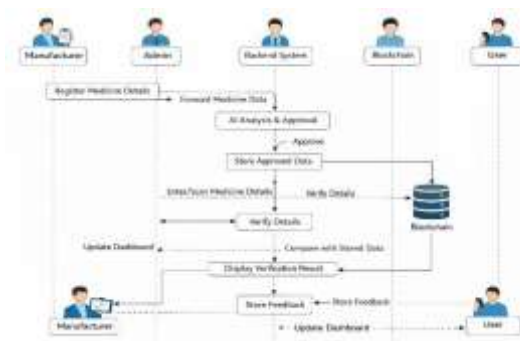
Figure 1: Illustrates the workflow of the Med-Detect system for counterfeit medicine detection. The process starts with the manufacturer registering medicine details, which are verified by the admin using AI techniques. Approved data is securely stored in the blockchain to ensure transparency and immutability. Users then enter or scan medicine details, which are compared with blockchain records in the backend. Based on this comparison, the system displays whether the medicine is real or fake. Additionally, users can submit feedback, which is stored and shown on the manufacturer dashboard. This system enhances secure authentication and improves medicine quality through continuous monitoring.



[Fig. 1: Dataflow Diagram]

B. Sequence Diagram

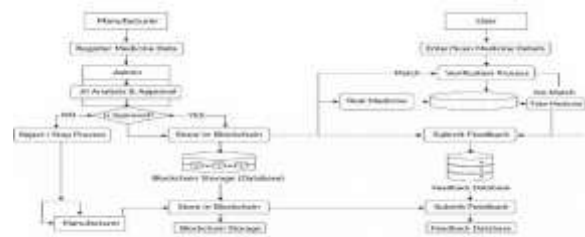
Figure 2: A sequence diagram represents how different components of a system interact with each other in a specific order over time. In the Med-Detect system, it shows the interaction between the manufacturer, admin, backend system, blockchain, and user. The process starts with the manufacturer registering medicine data, followed by admin verification and approval. The backend then stores approved data in the blockchain and processes user verification requests. Finally, the system returns the result to the user and handles feedback, completing the interaction flow.



[Fig. 2: Sequence Diagram]

C. Workflow Diagram

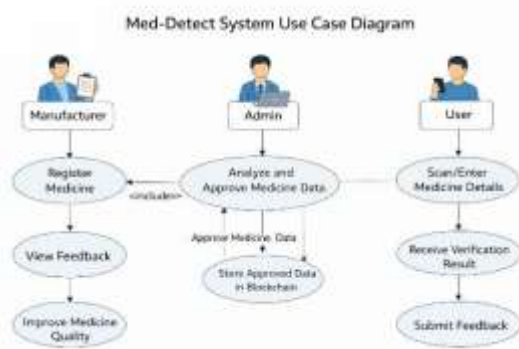
Figure 3: This figure shows workflow begins with authorized manufacturers securely uploading new medicine batch details into the system. System administrators then review these pending batches, utilizing Gemini AI to analyze the chemical composition and flag any anomalies before granting manual approval. Once a medicine is approved, the backend generates a secure SHA-256 hash that cryptographically links the new batch to the previous one, forming a tamper-evident block. This block is permanently recorded in the system's immutable SQLite blockchain ledger. Finally, consumers can verify their medicine by searching for its batch ID, which instantly queries the secure ledger to return a reliable "REAL" or "FAKE" authenticity



[Fig. 3: Workflow Diagram]

D. Use Case Diagram

As shown in Fig. 4, it represents the interaction between different users (actors) and the system functionalities. In the Med-Detect system, the main actors are the Manufacturer, Admin, and User. The Manufacturer registers medicines and views feedback, while the Admin analyzes and approves medicine data. The User scans or enters medicine details and receives verification results. It also shows how users submit feedback, which helps manufacturers improve medicine quality.



[Fig. 4: Usecase Diagram]

V. TESTING AND RESULTS

A. Testing

A thorough testing process was conducted on various aspects of the system:

- **Functional Testing:** Checks whether medicine registration, admin approval, verification process, and feedback submission work properly.
- **Unit Testing:** Individual modules such as medicine registration, authentication process, blockchain storage, and feedback system are separately tested.
- **Integration Testing:** Tests that all components, including frontend, backend, database, and blockchain, interact smoothly.
- **UI Testing:** Ensures that the frontend interface is user-friendly, responsive, and easy to navigate.

- **Data Validation Testing:** Validates user-entered medicine details to avoid incorrect or incomplete data during verification.
- **Verification Accuracy Testing:** Ensures the system correctly identifies medicines as real or fake based on stored blockchain data.
- **Performance Testing:** Tests how quickly the system responds during medicine verification and data retrieval.

B. Results

As shown in Fig. 5, Shows a web application interface that uses AI and Blockchain to securely store, analyse, and verify the authenticity of medicines in real time.



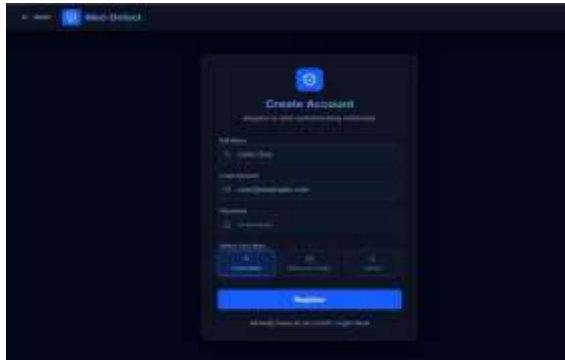
[Fig. 5: Med-Detect Homepage Interface]

Fig. 6 shows a page where users can choose between Consumer, Manufacture and Admin roles to access the system.



[Fig. 6: Portal Selection page]

Fig. 7.1 & 7.2 : shows a Registration and login pages where Admin,Manufacturer,User can create an account by selecting role.



[Fig:7.1 Create Account]



[Fig. 7.2: login portal]

Fig 8: After Consumer Login, this page opens where the user can enter or scan the medicine details to verify its authenticity.



[Fig 8:Medicine verification page]

Fig 9.1 & 9.2: Shows about the Medicine Authentication, Whether it is fake or real.



[Fig 9.1: It Indicates Real medicine]



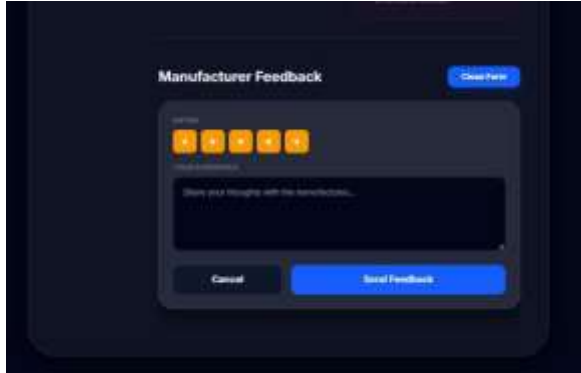
[Fig 9.2: It Indicates Fake Medicine]

Fig 10: It Shows about after identifying the medicine as a Real image the user can analyse about the medicine and it shows about the medicine.



[Fig 10: About Medicine]

Fig 11: It Shows about the Feedback option, User can give their feedback to the Medicine Manufacturer. So that the Medicine manufacturer can improve their Medicine Quality.



[Fig 11: Feedback form]

Fig 12: Shows Dashboard displaying Scanned Medicines with total scans, number of Real and Fake medicines and Visual Charts.



[Fig 12: Dashboard of User]

Fig 13: Shows Scan history page where users can view previous verified Medicines along with their results.



[Fig 13: History]

VI. CONCLUSION

The Med-Detect system introduces a practical and impactful solution to the growing problem of counterfeit medicines in the healthcare sector. By enabling manufacturers to register medicines and incorporating an admin-based verification process, the system ensures that only validated and trusted data is stored. The integration of blockchain technology adds an extra layer of security by maintaining immutable records, which prevents unauthorized modifications. This structured approach creates a reliable environment where medicine authenticity can be managed efficiently. The system focuses on delivering accurate and real-time verification, making it highly useful for everyday users. Its design ensures that complex processes are handled in the backend while providing a simple interface to users. As a result, Med-Detect improves both safety and accessibility in medicine verification.

The user interaction component of the system plays a crucial role in enhancing its effectiveness and usability. Users can easily scan or enter medicine details, and the system instantly verifies the data by comparing it with blockchain records. Based on this comparison, clear results are provided, helping users identify whether a medicine is genuine or counterfeit. This real-time response reduces dependency on unreliable manual methods and increases user confidence. Additionally, the system ensures that verification is quick and does not require technical knowledge, making it accessible to a wide range of users. The seamless integration between frontend and backend components ensures smooth operation and consistent performance. This user-centered design makes the system both efficient and practical in real-world scenarios.

Another key strength of Med-Detect is its feedback-driven improvement mechanism, which enhances medicine quality continuously. Users can submit feedback that is stored and displayed on the manufacturer dashboard for analysis. This enables manufacturers to identify issues and improve their products effectively. The involvement of users, manufacturers, and admins creates a balanced and efficient ecosystem. Overall, the system ensures better quality, reliability, and trust in the pharmaceutical supply chain.

REFERENCES

- [1] K. Reddy and P. Sharma, "Blockchain and OCR-Based Medicine Verification System," Journal of Advanced Re- search in Computer Science, 2024.
- [2] L. Chen, X. Zhao, and Y. Liu, "IoT and Blockchain- Based Medicine Supply Chain Monitoring," IEEE Access, 2023.
- [3] A. Seker, M. Demir, and H. Kaya, "Expiration Date Recognition Using Fully Convolutional Networks," Journal of Image Processing and Applications, 2022.
- [4] Y. Wang, Z. Li, and Q. Chen, "Counterfeit Drug Detec- tion Using Machine Learning Techniques," International Journal of Computer Vision Applications, 2021.
- [5] M. Ramalingam and S. Kumar, "Expiry Date Detection Using QR Code Technology," International Journal of Inno- vative Technology and Research, 2020.
- [6] H. Zhang, Y. Wu, and L. Sun, "Fake Medicine Detection Using RFID and IoT Systems," Journal of Healthcare Engi- neering, 2019.
- [7] X. Li, J. Chen, and P. Zhou, "Blockchain-Based Drug Traceability in Pharmaceutical Supply Chain," Future Gen- eration Computer Systems, 2018.