

(Medguardai) AI + Blockchain Based Fake Medicine Detection System

Prof. Vaishali N. Shelokar¹, Saloni V. Chapke², Priti G. Rathod³, Bhavik V. Ghati⁴, Yash A. Deshmukh⁵

Dept. Of Information Technology, Prof Ram Meghe College Of Engineering And Management, Badnera, Amravati, Maharashtra India, 444701 Sant Gadge Baba Amravati University Amravati Maharashtra, India

DOI: <https://doi.org/10.51584/IJRIAS.2026.11010058>

Received: 19 January 2026; Accepted: 25 January 2026; Published: 04 February 2026

ABSTRACT

The increasing circulation of counterfeit and unsafe medicines poses a serious threat to public health worldwide. Traditional verification methods such as manual checks and barcode validation often fail to provide real-time and reliable authentication to end users. This paper presents MedGuardAI, an intelligent medicine verification system that combines image-based scanning, QR code validation, artificial intelligence, and trusted data sources to ensure medicine authenticity and patient safety. The proposed system allows users to scan medicine packaging or upload images through a mobile application to verify authenticity, view confidence scores, and receive safety-related information. Additionally, the system supports disease-based medicine search to assist users with preliminary guidance while emphasizing medical consultation. Experimental evaluation and application results demonstrate that MedGuardAI offers an effective, user-friendly, and scalable solution for counterfeit drug detection and medicine awareness.

Keywords: Counterfeit Medicine Detection, Artificial Intelligence, QR Code Verification, Healthcare Security, Mobile Application.

INTRODUCTION

Counterfeit medicines have become a global healthcare challenge, leading to ineffective treatment, adverse health effects, and loss of trust in medical systems. According to health regulatory authorities, a significant percentage of medicines circulating in developing regions are either fake, expired, or improperly labeled. Existing systems mainly focus on supply-chain verification and fail to provide direct verification tools for patients.

With the rapid advancement of mobile technology and artificial intelligence, there is a growing opportunity to empower users with real-time medicine authentication tools. MedGuardAI is designed to address this gap by offering a patient-centric solution that enables medicine verification through QR code scanning and image analysis. The system provides instant feedback regarding medicine authenticity along with confidence indicators, helping users make informed decisions. By integrating verified data sources and AI-driven analysis, MedGuardAI aims to enhance medicine safety and reduce the risks associated with counterfeit drugs.

LITERATURE REVIEW

[1] Pranitha G. (2024), in her work “*Fake Drug Detection using QR Codes and Consensus-Based Blockchain*”, proposed a blockchain-driven framework where each medicine is assigned a unique QR code and registered on a distributed ledger. The system relies on consensus mechanisms to validate authenticity and allows consumers to verify drugs through QR scanning. While the approach improves transparency, it mainly focuses on authentication and lacks intelligent analysis. MedGuardAI extends this work by integrating AI-based verification capable of detecting expired and unsafe medicines, along with IPFS-based decentralized storage for preserving scan evidence and audit trails.

[2] Poornima S., Ranjit T. N., Sanjith Sivendra K., Vasani S., and Kawin K. S. (2025), in “*Med Verify: A Blockchain-Based Medicine Verification System for Counterfeit Drug Detection*”, introduced a system

combining QR codes or RFID tags with blockchain and AI-driven packaging inspection. Their methodology emphasizes identifying counterfeit drugs through packaging consistency and recorded supply-chain data. However, the system remains largely packaging-centric. MedGuardAI improves upon this by incorporating image recognition and NLP techniques to validate dosage and usage instructions while providing real-time AI-generated safety alerts aimed at patient protection.

[3] Mani V. et al. (2022), in “*Cloud-Based Blockchain Technology to Identify Counterfeits*”, presented a cloud-supported blockchain architecture using serialization for unique drug identification and IPFS for storing verification evidence. The model ensures scalability and secure backend logging of pharmaceutical data. Although effective in maintaining data integrity, the approach lacks direct user-level intelligence. MedGuardAI enhances this architecture by adding AI-powered analysis that delivers immediate authenticity and safety insights to end users rather than limiting verification to backend records.

[4] Vivek Singh et al. (2019), in “*A Novel Approach for Counterfeit Detection of Medical Drugs using Blockchain*”, proposed the use of RFID tags and blockchain to track medicines throughout the supply chain. Consumers verify authenticity through a mobile application that accesses blockchain-stored transaction data. Despite improving traceability, RFID dependency increases deployment cost and limits accessibility. MedGuardAI replaces hardware dependency with AI-based image and QR scanning, integrates expiry detection and safety warnings, and uses IPFS to store image-based proof for improved transparency.

[5] Chandan Kumar Sahoo et al. (2020), in “*Combating Counterfeit Drugs: A Blockchain and IoT-Based Approach*”, developed a framework that integrates IoT sensors with blockchain and smart contracts to monitor drug movement across the supply chain. Smart contracts enforce compliance at each distribution stage. While effective for logistics monitoring, the system does not focus on patient-level verification. MedGuardAI complements supply-chain integrity by incorporating AI and NLP to deliver patient-centric verification, usage validation, and decentralized cloud and IPFS-based data storage.

[6] Vinay B. Kapse et al. (2021), in “*Blockchain and Machine Learning Based Framework for Counterfeit Drug Detection*”, employed machine learning algorithms to identify anomalies in drug packaging, with blockchain used for storing verification results. The solution primarily operates at the backend level and offers limited real-time user interaction. MedGuardAI advances this concept by providing front-end AI scanning, instant alerts, and visual and NLP-based instruction validation, ensuring both backend security and patient-facing safety.

[7] Mani V. et al. (2022), in another study on cloud-based blockchain counterfeit detection, utilized serialization, blockchain ledgers, IPFS storage, and cloud infrastructure to ensure scalable and tamper-proof verification. Although the system ensures data integrity, it does not actively assist end users during verification. MedGuardAI integrates AI-powered detection with IPFS-based image storage and presents real-time safety insights directly through a mobile interface, enhancing usability and responsiveness.

[8] Pranitha G. (2024), in a subsequent study on QR code-based counterfeit detection, employed consensus-based blockchain validation to authenticate medicine records during consumer scans. While effective for authentication, the approach lacks contextual safety analysis. MedGuardAI enhances this method by introducing AI-driven risk analysis and decentralized evidence storage using IPFS, making verification more robust and informative for end users.

[9] Poornima S. et al. (2025), in their extended work on *Med Verify*, continued to focus on QR/RFID-based authentication and AI-driven packaging analysis. Their system ensures packaging integrity but offers limited support for patient understanding and safety feedback. MedGuardAI broadens verification by incorporating NLP-based instruction analysis, real-time alerts, and IPFS-backed scan storage, thereby improving user trust and safety awareness.

[10] Nikita Panchal et al. (2022), in “*BlockMed: Blockchain for Drug Supply Chain Integrity*”, utilized Ethereum smart contracts to track medicine movement across the pharmaceutical supply chain. The system ensures transaction integrity and traceability but does not actively detect counterfeit medicines at the user level. MedGuardAI extends this work by integrating AI-based scanning, decentralized evidence storage, and immediate safety notifications, enabling real-time counterfeit detection for consumers.

System Overview

The MedGuardAI application provides a simple and intuitive interface for medicine verification. Users can scan a QR code printed on the medicine package or upload an image of the medicine label. The system processes the input data and verifies it against trusted manufacturer information and regulatory sources. A confidence score is generated and displayed to the user, indicating the likelihood of authenticity.

In addition to verification, the application includes a disease-based medicine search feature. This module suggests commonly used medicines based on user-entered symptoms or diseases while clearly advising consultation with medical professionals. The application interface is designed to be accessible, making it suitable for both urban and rural users.

METHODOLOGY

The methodology of MedGuardAI consists of multiple interconnected modules that ensure accuracy, transparency, and usability. Initially, the user provides input through QR code scanning or image upload. The captured data is preprocessed to extract textual and visual features such as medicine name, manufacturer, and packaging details.

Artificial intelligence techniques are applied to analyse the extracted information and detect inconsistencies or suspicious patterns. The verification process includes cross-checking data with authenticated manufacturer sources and regulatory datasets. Based on this analysis, the system classifies the medicine status and generates a confidence level.

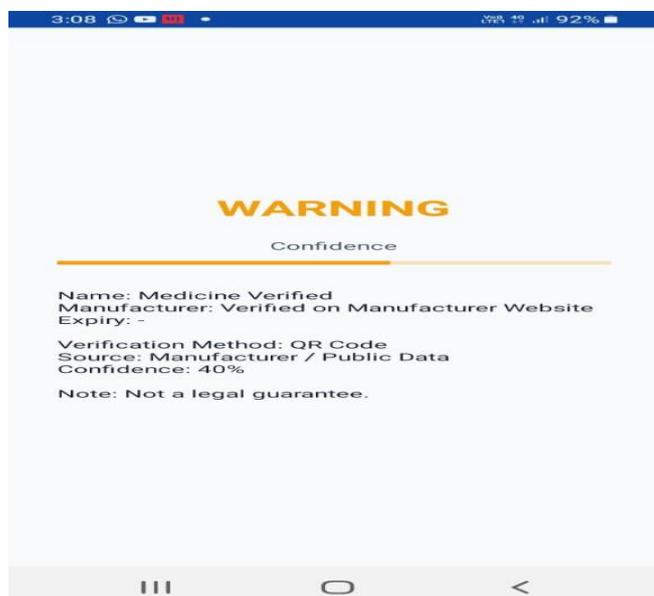
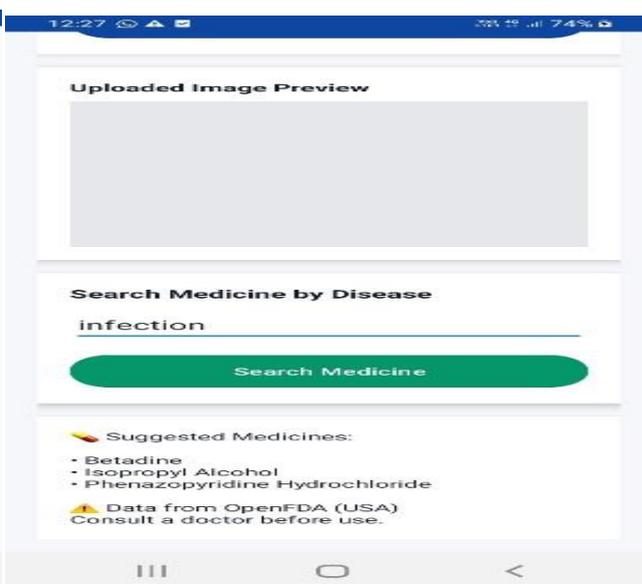
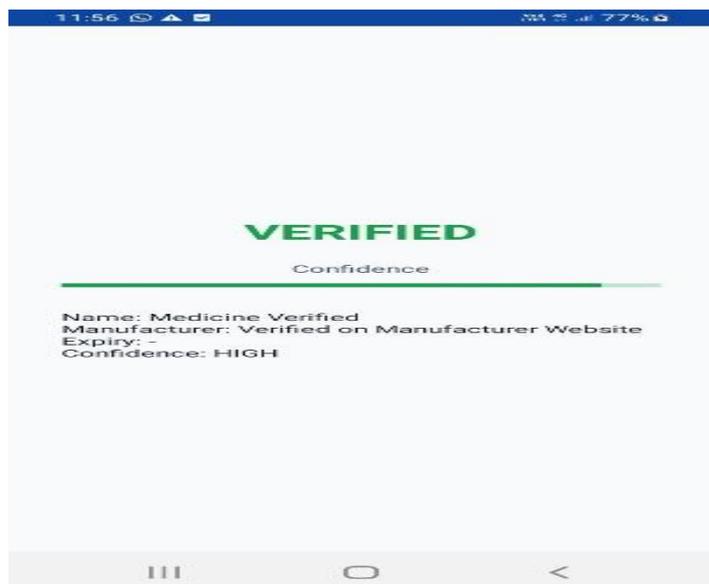
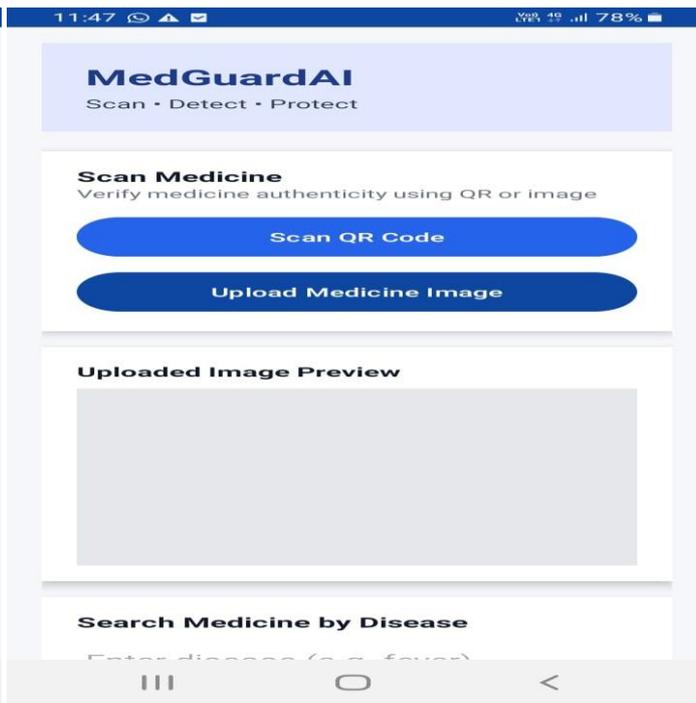
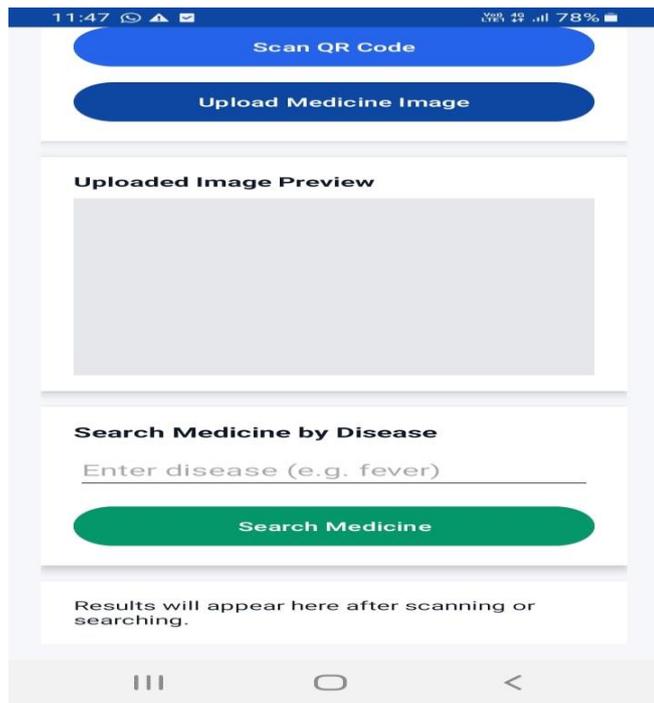
The final verification result is presented to the user in a clear and understandable format, highlighting whether the medicine is verified or suspicious. This end-to-end workflow ensures fast response time while maintaining reliability and ease of use.

Implementation Details

The MedGuardAI application is implemented as a mobile-based system with a clean and responsive user interface. The scan module enables QR code reading and image upload functionality. The backend processes requests and performs verification using AI-based logic and trusted data references.

The disease-based search module retrieves medicine suggestions from verified medical datasets. Clear warnings and disclaimers are included to ensure ethical usage and prevent self-medication misuse. The confidence bar displayed in the verification screen visually communicates trust levels to users, improving interpretability and decision-making.

RESULT AND DISCUSSION



The application was tested with multiple medicine samples and use cases. The results show that MedGuardAI successfully verifies medicine authenticity and provides confidence-based feedback to users. The visual confidence indicator improves user trust and understanding compared to traditional text-only verification systems.

The disease-based medicine search feature enhances user engagement while maintaining safety by advising professional consultation. Compared to conventional systems, MedGuardAI offers faster verification, improved usability, and better patient awareness. The results indicate that integrating AI with mobile healthcare applications can significantly enhance medicine safety at the user level.

ACKNOWLEDGE

The authors would like to express their sincere gratitude to their project guide for providing continuous guidance, technical insights, and valuable feedback throughout the development of this research work. The consistent support and expert suggestions greatly contributed to improving the system design and research quality.

The authors also extend their appreciation to the Head of the Department and all faculty members for their encouragement and academic support.

Finally, the authors would like to acknowledge the encouragement and moral support provided by friends, peers, and family members, whose motivation and understanding played an important role throughout the project duration.

Future Scope

Although MedGuardAI offers an effective solution for medicine verification, several enhancements can be explored in future developments. Integration of blockchain technology can be introduced to securely store verification records and ensure transparency and immutability across the pharmaceutical supply chain. This would further strengthen trust and auditability.

Advanced deep learning models can be implemented to improve image recognition accuracy, especially for visually similar counterfeit packaging. Multi-language support can be added to make the application accessible to a wider population, including users in rural and semi-urban regions. Additionally, incorporating offline or low-connectivity verification features can enhance usability in areas with limited internet access.

CONCLUSION

This research work presented MedGuardAI, a mobile-based intelligent system for verifying medicine authenticity and enhancing patient safety. By integrating QR code scanning, image-based analysis, and AI-driven validation, the system enables reliable and user-friendly medicine authentication.

MedGuardAI provides clear verification results with confidence indicators and includes a disease-based medicine search feature to improve user awareness while promoting responsible medical consultation. The results show that the system improves trust, reduces reliance on manual checks, and supports safer medicine usage. Overall, MedGuardAI highlights the effective use of AI and mobile technologies in addressing counterfeit medicine challenges.

REFERENCES

1. Poornima S., Ranjit T. N., Sanjith Sivendra K., Vasam S., and Kawin K. S., "Med Verify: A Blockchain-Based Medicine Verification System for Counterfeit Drug Detection," 2025.
2. G. Pranitha, "Fake Drug Detection using QR Codes and Consensus Based Blockchain," 2024.
3. Mrudula S. G. et al., "Blockchain-based Approach for Securing Drug Supply Chain," 2023.
4. Prashant S. et al., "Blockchain and ML Framework to Prevent Drug Counterfeiting," 2023.
5. Nikita Panchal et al., "BlockMed: Blockchain for Drug Supply Chain Integrity," 2022.

6. V. Mani et al., “Cloud-Based Blockchain Technology to Identify Counterfeits,” 2022.
7. Pharma Chain: Blockchain-Based Drug Supply Chain Provenance Verification System Heliyon Research Team Heliyon, vol. 9, issue 7, e17957 | July 2023.
8. Securing Drug Distribution Systems from Tampering Using Blockchain M. Humayun, N. Z. Jhanjhi, M. Niazi, F. Amsaad, I. Masood Electronics, vol. 11, no. 8, p. 1195 | 2022 | DOI: 10.3390/electronics11081195
9. Cloud-based Blockchain Technology to Identify Counterfeits V. Mani, M. Prakash, W. C. Lai Journal of Cloud Computing, vol. 11, art. no. 67 | 2022 | DOI: 10.1186/s13677-022-00341-2
10. A Blockchain and Machine Learning-Based Drug Supply Chain Management and Recommendation System for Smart Pharmaceutical Industry K. Abbas, M. Afaq, T. A. Khan, W.-C. Song PRMCEAM 16 MedGaurdAi Electronics, vol. 9, no. 5, p. 852 | (Published around 2020 based on volume info) | DOI: 10.3390/electronics9050852
11. Detecting Counterfeit Medicines B. Naughton, D. Brindley Oxford News Blog | January 27, 2017 | [Online] Available: [https://www.ox.ac.uk/news/science blog/detecting-counterfeit-medicines](https://www.ox.ac.uk/news/science%20blog/detecting-counterfeit-medicines)