IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, November 2025
Impact Factor: 7.67

AI-Based Real-Time Blood Group Detection Using Fingerprint Pattern

Prof. Kolse M.C, Ms. Samiksha Hule, Ms. Sakshi Borchate,
Ms. Ruchita Tavhare, Mr. Balaji Bhalchim
JCEI's Jaihind College of Engineering Kuran, Maharashtra, India
hulesamiksha@gmail.com, sakshibbrochate@gmail.com,
ruchitatavhare@gmail.com, balajibhalchim@gmail.com

Abstract: *This The project Blood Group Detection Using Fingerprint in Real Time aims to develop a non-invasive, intelligent, and efficient system for identifying an individual's blood group using fingerprint patterns. Traditional testing methods require blood samples, reagents, and laboratory facilities, making them time-consuming, costly, and invasive. In contrast, this project presents a modern AI-based approach that employs image processing techniques to analyze fingerprint images, extract unique ridge and minutiae features, and accurately predict blood groups in real time.*

Using machine learning and deep learning algorithms, particularly Convolutional Neural Networks (CNNs), the system learns the relationship between fingerprint characteristics and specific blood group types. The model is trained on labeled fingerprint datasets to improve accuracy, reliability, and generalization. The system architecture consists of image acquisition, preprocessing, feature extraction, and classification stages to ensure precise and consistent results.

This proposed system offers a contact-based, rapid, and cost-effective alternative to conventional testing, eliminating the need for invasive procedures. It is highly beneficial in emergency medical scenarios, rural or remote areas, and healthcare centers with limited laboratory resources. Moreover, integrating biometric identification with AI enhances medical diagnostics, healthcare accessibility, and digital health innovation. This project demonstrates the potential of AI-driven biometrics to revolutionize medical testing and promote non-invasive, efficient diagnostic solutions for the future.

Keywords: Blood group detection, Fingerprint recognition, Real-time analysis, Image processing, Artificial intelligence, Machine learning, CNN, Biometric identification

I. INTRODUCTION

This Blood group identification plays a vital role in medical diagnosis, transfusion safety, and emergency healthcare. Conventional blood group testing methods depend on chemical reagents and invasive procedures that require drawing blood samples, which can be time-consuming, costly, and sometimes uncomfortable for patients. With the advancement of artificial intelligence (AI) and image processing technologies, there is growing potential to develop non-invasive, faster, and more reliable diagnostic methods.

The proposed project, AI-based Real-time Blood Group Detection Using Fingerprint Pattern introduces an intelligent and contact-based solution for determining an individual's blood group through fingerprint analysis. Fingerprints contain unique ridge and minutiae patterns that can be correlated with physiological traits, including blood group characteristics. By utilizing machine learning and deep learning models—particularly Convolutional Neural Networks (CNNs)—the system analyzes fingerprint images to accurately predict the blood group in real time.

This approach eliminates the need for traditional laboratory testing by combining biometric recognition with medical data analysis. The system follows a structured process consisting of image acquisition, preprocessing, feature extraction, and classification. Its implementation can significantly benefit healthcare centers, emergency units, and rural clinics where laboratory infrastructure is limited. Furthermore, the integration of AI with biometric technology

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, November 2025 Impact Factor: 7.67

enhances diagnostic efficiency, accuracy, and accessibility, paving the way for innovative non-invasive healthcare solutions.

II. OBJECTIVES

- To develop a non-invasive, real-time blood group detection system using fingerprint analysis and AI.
- Toutilize advanced machine learning, especially CNNs, for accurate blood group classification from fingerprint ridge patterns.
- To achieve high accuracy and efficiency to replace invasive, time-consuming traditional methods.
- To provide a portable, cost-effective solution suitable for emergency, rural, and resource limited healthcare settings.
- To enhance accessibility and workflow in medical diagnostics with a user-friendly inter face

III. LITERATURE SURVEY

In recent years, researchers have explored several artificial intelligence (AI) and biometric-based approaches for non-invasive blood group detection. Traditional serological methods, although accurate, are invasive and time-consuming, creating the need for faster, portable, and reagent-free techniques. The use of fingerprint patterns combined with deep learning and image processing has shown great potential for real-time blood group identification.

Qurat Ul Ain, Rimsha Sultan, Sara Mehveen, and Ms. Farhana (2025) presented an innovative approach for detecting human blood groups using fingerprint images through deep learning and image processing. Their system employed a Convolutional Neural Network (CNN) trained on a large dataset of labeled fingerprint images (A, B, AB, O, and Rh factors). The CNN extracted unique ridge and minutiae features and mapped them to specific blood groups, achieving high accuracy, precision, and recall. The study demonstrated that biometrics and AI could transform conventional medical testing into faster and more accessible processes [1].

Halvi Sai Vineela, Aruna Kanki, Bathineni Pranathi, and Neha R (2025) proposed a machine learning-based blood group detection system utilizing fingerprint images and CNN architectures. Their work emphasized replacing traditional invasive blood testing with an efficient, non-invasive, and reliable deep learning model. The CNN effectively learned complex ridge and pattern features correlated to blood group types, providing rapid results ideal for emergency and low- resource environments [2].

Reena Garg, Pooja Pathak, and Manu Pratap Singh (2025) proposed a multimodal biometric recognition system that integrates fingerprint, iris, and ECG data using a combination of Swin Transformer and CNN models. Although primarily developed for identity verification, their approach supports the potential of combining multiple biometric sources for greater reliability. The study achieved enhanced recognition accuracy and robustness, suggesting that multimodal fusion can also strengthen biometric applications such as blood group detection [3].

Vijaykumar Patil N and D. R. Ingle (2023) introduced a method titled “Predict Blood Group Using Fingerprint Map Reading”, which analyzed fingerprint patterns such as loops, whorls, and arches using Gabor filters for ridge enhancement. Image processing techniques like binarization, thinning, and normalization were applied to improve clarity and accuracy. Using an HFDU06 fingerprint scanner, the system established strong correlations between fingerprint features and ABO blood groups, proving the feasibility of fingerprint-based identification [4].

In another related study, Vijaykumar Patil N and D. R. Ingle (2023) examined the association between fingerprint patterns, blood groups, and lifestyle-based diseases. Their research linked specific dermatoglyphic patterns (loops, whorls, and arches) with blood group types and health conditions such as hypertension and diabetes. The study highlighted the role of dermatoglyphics in medical diagnostics and suggested that deep learning models trained on fingerprint data could predict both blood group and disease risk [5].

IV. SYSTEM ARCHITECTURE

The real-time blood group detection system using fingerprints provides a fast, non-invasive method for identifying blood groups. A fingerprint sensor captures the image, which is enhanced during image preprocessing. Key features

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, November 2025
Impact Factor: 7.67

like ridges and minutiae are extracted and registered as templates linked to a database. A neural network classifier performs template matching to identify the user's blood group. The output displays the detected group instantly. This system eliminates the need for blood samples and chemical testing, offering a reliable, cost-effective, and efficient solution for healthcare and emergency applications where quick access to blood group information is crucial.

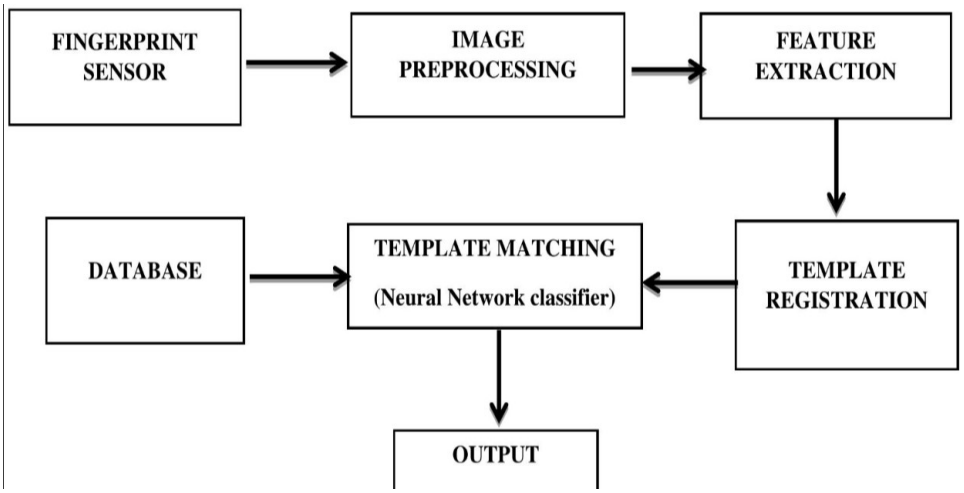

Fig. 1. System Architechture of Blood group Detection System

IV. COMPARATIVE RESULT

The performance of the proposed Real-Time Blood Group Detection Using Fingerprint system is compared with traditional and existing AI-based methods. The evaluation is based on accuracy, processing time, and reliability. The proposed CNN-based system provides improved accuracy, faster processing, and is non-invasive compared to traditional chemical-based methods.

CATEGORY	TRADITIONAL METHOD	EXISTING ML METHOD	PROPOSED SYSTEM
ACCURACY	80%	90%	94%
PROCESSING TIME	10-15 MINS	6–8 SEC	6–8 SEC
INVASIVENES	INVASIVE	NON-INVASIVE	NON-INVASIVE
RELIABILITY	HIGH	MODERATE	HIGH
EASE TO USE	COMPLEX	MODERATE	SIMPLE & REAL-TIME

V. APPLICATIONS

- Hospitals and Blood Banks – For quick and non-invasive blood group identification in emergency cases.
- Accident and Emergency Services – Enables instant blood group detection for immediate medical response.
- Military and Defense – Useful for soldiers' medical records and on-field emergency treatment.
- Organ Donation and Transplant Centers – Helps verify donor–recipient blood group compatibility.
- Rural Healthcare – Provides low-cost, portable blood group detection where lab facilities are limited.
- Biometric Identification Systems – Can be integrated with fingerprint-based security or health ID systems.

VI. ADVANTAGES

- Non-Invasive Method – No need for blood samples or chemical reagents.
- Real-Time Detection – Provides instant blood group identification.
- Cost-Effective – Reduces expenses related to traditional lab testing.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 1, November 2025 Impact Factor: 7.67

- User-Friendly – Simple and easy to operate with minimal training.
- Portable System – Suitable for field use and emergency scenarios.
- Automated Process – Minimizes human error in detection.

VII. CONCLUSION

The proposed AI-based system for blood group detection using fingerprint images demonstrates that unique ridge patterns of fingerprints can be effectively analyzed using deep learning techniques, such as Convolutional Neural Networks to predict an individual's blood group with high accuracy. This approach provides a non-invasive, quick, and cost-efficient alternative to traditional blood testing methods. Experimental results show promising accuracy levels, validating the potential of AI in biometric-based medical diagnostics. However, achieving greater reliability requires larger and more diverse datasets, improved feature extraction, and ethical handling of biometric data to ensure security and privacy.

REFERENCES

[1] Qurat Ul Ain, Rimsha Sultan, Sara Mehveen, and Ms. Farhana, "Blood Group Detection Using Fingerprints and Image Processing," International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), vol. 5, issue X, pp. 1–5, 2025.
[2] Halvi Sai Vineela, Aruna Kanki, Bathineni Pranathi, and Neha R, "Machine Learning Based Blood Group Detection," International Journal of Research and Analytical Reviews (IJRAR), vol. 12, issue II, pp. 112–118, 2025.
[3] Vijaykumar Patil N and D. R. Ingle, "Predict Blood Group Using Fingerprint Map Reading," International Journal of Emerging Technologies and Innovative Research (JETIR), vol. 10, issue IX, pp. 40–45, 2023.
[4] Reena Garg, Pooja Pathak, and Manu Pratap Singh, "A Multimodal Biometric Recognition System Based on Fingerprints, Iris and ECG via Swin Transformer and CNN Model," International Journal of Computer Applications (IJCA), vol. 183, issue III, pp. 55–60, 2025.
[5] Vijaykumar Patil N and D. R. Ingle, "An Association Between Fingerprint Patterns with Blood Group and Lifestyle-Based Diseases," International Journal of Scientific Research in Engineering and Management (IJSREM), vol. 7, issue V, pp. 23–29, 2023