BASAVARAJESWARI GROUP OF INSTITUTIONS

# BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

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## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

**A Synopsis On**

# "Non-Invasive Blood Group Detection using Fingerprints"

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# 1. Vision and Mission statements

## 1.1 Vision

To revolutionize blood group identification through non-invasive, AI-powered biometric solutions, making rapid and accessible diagnostics a reality for every individual, everywhere.

## 1.2Mission

To develop an accurate, non-invasive blood group detection system using fingerprint biometrics and deep learning, enabling rapid and accessible diagnostics with interpretable AI

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## 2. Objectives

1. To eliminate the need for invasive blood sampling by using fingerprint images for blood group detection.
2. To develop a deep learning model using Convolutional Neural Networks (CNNs) that can accurately classify blood groups from fingerprint patterns.
3. To enhance model transparency and trust using Grad-CAM for visual explanation of predictions.
4. To enable real-time and accessible diagnostic support in emergency and remote healthcare settings

## 3. .Abstract

The Non-Invasive Blood Group Detection Using Fingerprint Project presents a biometrics based and deep learning technology. The traditional blood typing methods require physical samples and lab-based analysis, which can be time-consuming and impractical in emergency or remote settings. To address this issue, a methodology is proposed which incorporates the fingerprint-based classification model and Convolutional Neural Networks (CNNs). The project identifies blood groups directly from fingerprint images. To enhance interpretability and trust in the model's predictions, the system incorporates Gradient-weighted Class Activation Mapping (Grad-CAM). This technique visually highlights the regions of the fingerprint that influence the model's decisions, providing valuable insights into the learned features and ensuring transparency. The proposed system aims to enable fast, user-friendly, and accurate blood group detection without the need for invasive procedures. It has potential applications in healthcare diagnostics, biometric identification, and emergency medical response systems.

## 4.Introduction

The Non-Invasive Blood Group Detection Using Fingerprint project introduces a novel approach to identifying blood groups without the need for invasive procedures. Traditional methods require blood samples and laboratory analysis, which can be impractical in emergencies or remote locations. This project leverages fingerprint biometrics combined with deep learning, specifically Convolutional Neural Networks (CNNs), to classify blood groups directly from fingerprint images to provide a fast, accurate, and user-friendly alternative for blood group detection, with promising applications in healthcare diagnostics, biometric systems, and emergency medical services

## 5.Literature Review

**Table 1.1:Literature Review**

| Author | Data set Used | Key Findings | Limitations |
|---|---|---|---|
| Halvi Sai Vineela, Aruna Kanki, Bathineni Pranathi, Neha R | 2025 | Deep learning-based method for blood group detection using fingerprint and smear images; implemented with Python, Flask, HTML, CSS, JS. | Requires high-resolution image input; model accuracy may vary with poor-quality inputs or diverse image conditions. |
| T Nihar, K Yeswanth, K Prabhakar [1] | 2024 | Gabor Filter, CNN (LeNet or AlexNet) | Collected fingerprint images |
| Tannmay Gupta [2] | 2024 | Deep Learning (DL), MATLAB | Custom blood clump and fingerprint dataset |
| P. N. Vijaykumar, D. R. Ingle [3] | 2021 | Machine Learning, Multiple Linear Regression (OLS), Gabor filter | 82 students' fingerprints and blood groups |
| Helala AlShehri, Muhammad Hussain, Hatim AboAlSamh, Qazi Emad-ul-Haq, Aqil M. Azmi | 2019 | Matched fingerprints from different sensors more accurately | Works poorly with distorted prints |

# 6.Existing and Proposed System

## 6.1 Existing System

Existing systems for blood group detection rely on invasive blood sampling and lab-based analysis, which are time-consuming, require trained personnel, and are unsuitable for emergency or remote settings. Some use machine learning on blood samples but still depend on clinical environments.

## 6.2 Proposed System

The proposed system uses fingerprint images and deep learning (CNN) to detect blood groups non-invasively. It is fast, user-friendly, and suitable for real-time use without the need for lab equipment. Grad-CAM adds interpretability, making the system transparent, portable, and ideal for emergency and remote healthcare applications.

# 7.Hardware and Software Requirements

## 7.1 Hardware Requirements

Computer/Laptop – Minimum Intel i5 processor, 8 GB RAM, 256 GB SSD.

Storage Device – To store fingerprint images, models, and results.

## 7.2 Software Requirements

Operating System – Windows 10/11, Ubuntu, or macOS

Programming Language – Python

Deep Learning Framework – TensorFlow or PyTorch

Libraries – OpenCV, NumPy, Pandas, Matplotlib, scikit-learn

Explainability Tool – Grad-CAM .

IDE/Editor – VS Code.

# 8 Diagrams

## 8.1 Context Diagram (Level-0)

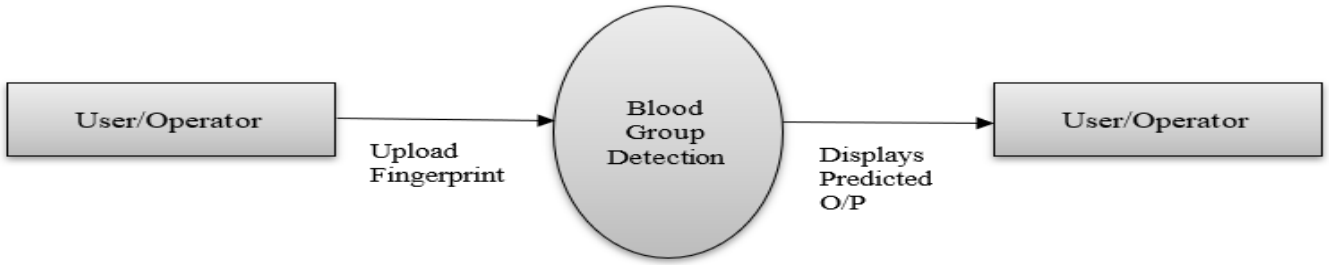


**Fig 1.1: Context diagram for Blood Group detection using Fingerprints**

## 8.2 Data Flow Diagram (Level-1)

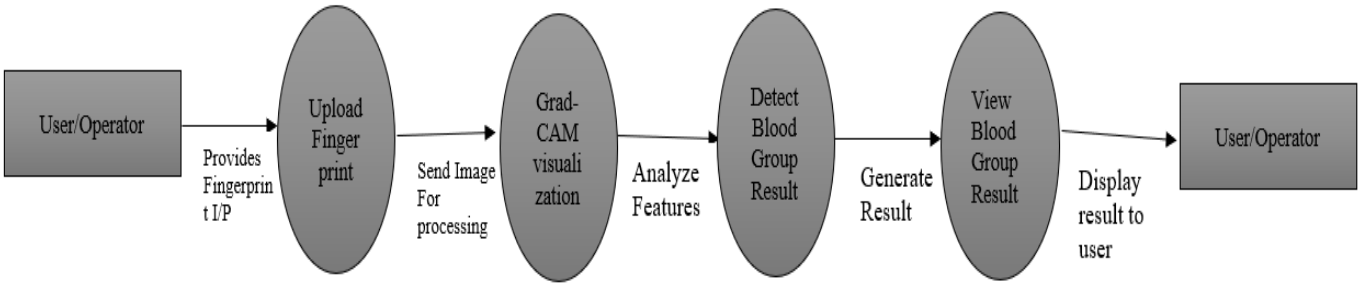


**Fig 1.2: Data Flow diagram for Blood group detection using Fingerprints**

## 8.3 Use Case Diagram

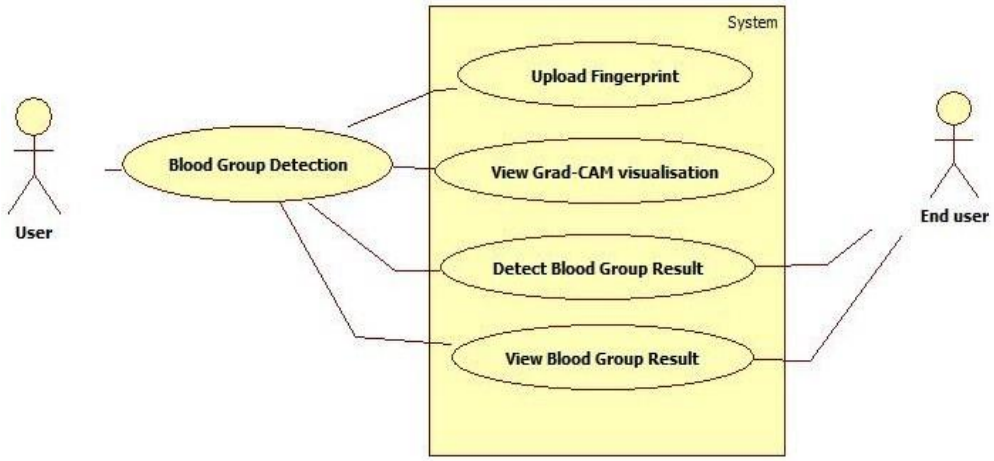


**Fig 1.3: Use-Case diagram for Blood Group detection using Fingerprint**

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