International Journal of Science, Strategic Management and Technology
Volume **02** Issue **05** May-**2026** | ISSN: **3108-1762 (Online)** | Impact Factor: 3.8
An International, Peer-Reviewed, Open Access Scholarly Journal Indexed in recognized academic databases

AI-Driven Smart Donation and Resource Management System for Food and Clothing Distribution

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https://doi.org/10.55041/ijsmt.v2i5.365

Cite this Article: Sahu, S. K., Gupta, S., Mourya, S. & Lodhi, S. (2026). AI-Driven Smart Donation and Resource Management System for Food and Clothing Distribution. International Journal of Science, Strategic Management and Technology, *02*(05). https://doi.org/10.55041/ijsmt.v2i5.365

Abstract

The rapid increase in urban poverty, food wastage, and textile waste has created a significant need for intelligent donation management systems. Traditional donation platforms often suffer from lack of transparency, inefficient resource allocation, delayed deliveries, and poor communication between donors, NGOs, and beneficiaries. This research proposes an AI-driven Smart Donation and Resource Management System that automates the collection, classification, verification, and distribution of food and clothing donations.

The proposed system integrates Artificial Intelligence (AI), Machine Learning (ML), Computer Vision, and Cloud Computing technologies to optimize donation workflows. Convolutional Neural Networks (CNNs) are used for cloth damage detection and quality assessment, while predictive algorithms analyze food freshness and suitability based on environmental and user-provided parameters. The system also provides real-time tracking, volunteer management, donor reward mechanisms, and intelligent location-based distribution.

The research highlights how AI can improve transparency, reduce waste, increase operational efficiency, and support sustainable social welfare activities. The system further promotes employment opportunities through cloth recycling and small-scale tailoring support. Future
enhancements include Blockchain integration, smart logistics optimization, and real-time analytics dashboards.

Keywords: Artificial Intelligence, Donation Management System, CNN, Food Detection, Cloth Recycling, Smart NGO System, Machine Learning, Resource Optimization

1. Introduction

The increasing gap between resource availability and resource accessibility has become one of the major social concerns in developing countries. Millions of people still struggle to obtain basic
necessities such as food and clothing despite the availability of surplus resources in urban areas. Traditional charity and donation systems often fail due to inefficient logistics, lack of transparency, improper verification, and manual management processes.

Modern technologies such as Artificial Intelligence (AI) and Machine Learning (ML) provide opportunities to transform conventional donation systems into intelligent, automated, and
transparent platforms. The proposed system aims to create a smart donation ecosystem where donors, NGOs, volunteers, and beneficiaries are connected through an integrated digital platform.

The system focuses on:

Food donation management Cloth quality assessment
Smart resource allocation AI-based decision making

Real-time volunteer coordination Donation tracking and analytics

The platform encourages individuals to donate usable surplus food and clothing while ensuring that donated resources reach the appropriate beneficiaries efficiently.

2. Problem Statement

Existing donation systems face several challenges:

Lack of transparency in donation handling Improper verification of donated items Food wastage due to delayed distribution Manual inspection of clothing quality
Poor communication between NGOs and donors Absence of real-time tracking systems
Inefficient volunteer management Limited trust among donors
These limitations reduce operational efficiency and discourage public participation in donation activities.

3. Objectives of the Proposed System

The major objectives of the proposed system are:

To develop an AI-enabled donation management platform.

To automate food and clothing verification using Machine Learning. To classify damaged and reusable clothes using CNN models.
To analyze food quality and expiration risk using predictive algorithms. To improve transparency and trust in donation systems.
To reduce food and textile waste.

To optimize resource distribution through location intelligence. To provide real-time monitoring and analytics for administrators.

4. Literature Review

Several researchers have contributed toward intelligent donation management systems and smart charity platforms.

Previous studies focused on:

Web-based NGO management systems IoT-enabled charity automation
Android-based donation applications AI-based resource allocation systems
Location-based donation delivery services However, existing systems still lack:
Intelligent cloth quality detection Automated food safety prediction
Real-time AI-based decision making Integrated recycling workflows
Advanced transparency mechanisms

The proposed system addresses these gaps through AIML integration and automation technologies.

5. Proposed System Architecture

The proposed architecture consists of the following modules:

5.1 User Module

Registration and authentication Donation submission
Image upload for clothes Food detail entry Donation tracking

5.2 AI Processing Module

Cloth damage detection using CNN Food quality prediction
Donation categorization
Recycling recommendation engine

5.3 Admin Module Donation approval Inventory management Volunteer assignment
Real-time monitoring dashboard

5.4 Volunteer Module

Pickup scheduling

Delivery confirmation GPS tracking

5.5 Beneficiary Module

Request management Location-based allocation Delivery verification

6. Methodology

The proposed system uses a hybrid AI-based methodology.

6.1 Cloth Damage Detection

A Convolutional Neural Network (CNN) model is trained using cloth image datasets to identify: Tears
Stains

Fabric damage

Recyclable material quality

The model classifies clothes into:

Directly reusable Repairable
Recyclable Non-usable

6.2 Food Quality Prediction

The food analysis system evaluates:

Food preparation time Storage conditions Climate data
Expiration probability

Machine learning algorithms estimate food freshness and safe consumption duration.

6.3 Database and Cloud Integration

Cloud databases store:

User records Donation logs
AI prediction results Volunteer activities Delivery status
Cloud integration improves scalability and accessibility.

7. Technologies Used

Technology Purpose
Android Studio

Mobile application development Firebase
Authentication and real-time database TensorFlow
AI model training Python
Machine Learning implementation CNN
Cloth image classification Google Maps API Location tracking
Cloud Storage Data management

8. Results and Discussion

The proposed system demonstrates improvements in:

Donation transparency Resource utilization Food wastage reduction
Automated cloth quality analysis Volunteer coordination efficiency
The AI-based verification process reduces human errors and improves decision-making accuracy. Real-time monitoring and predictive analytics further enhance operational performance.

9. Research Gaps

Despite advancements in smart donation systems, several research gaps remain: Limited blockchain integration for transparency
Lack of fairness-aware AI systems

Insufficient real-time predictive logistics

Limited datasets for cloth damage analysis Security concerns in large-scale deployment

10. Future Scope

Future enhancements may include:

Blockchain-based donation tracking AI-powered demand forecasting
Drone-assisted delivery systems Smart warehouse automation
IoT-enabled food freshness sensors Advanced recommendation systems
Integration with government welfare schemes

11. Challenges

Major implementation challenges include:

Data privacy and cybersecurity AI bias and dataset limitations Real-time processing overhead
Volunteer availability management Internet connectivity in rural areas High cloud infrastructure costs

12. Conclusion

The proposed AI-Driven Smart Donation and Resource Management System provides an intelligent and scalable solution for addressing food and clothing distribution challenges. By integrating Artificial Intelligence, Machine Learning, and cloud technologies, the system enhances transparency, reduces wastage, and improves operational efficiency.

The platform not only supports social welfare activities but also promotes sustainability, employment generation, and digital transformation in NGO operations. With future integration of Blockchain, IoT, and predictive analytics, the system can evolve into a nationwide smart humanitarian support network.