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DAANSETU A Machine Learning-based Platform for Enhancing NGO-Donor Interactions

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***Abstract*— A machine learning-based end-to-end donation management system, DAANSETU facilitates the connection of verified Non-Governmental Organizations (NGOs) with donors of surplus resources. DAANSETU addresses a long-standing socio-environmental challenge: the squandering of excess food, clothing, medication, and educational resources when millions of people cannot access such resources. The efficacy, accountability, and transparency of a donation system are greatly enhanced through DAANSETU, leveraging demand forecasting, matching, and tracking. This document presents an overview of all stages of the DAANSETU system development, starting with system design, coding, testing, and finally deployment. The system was created using Firebase Realtime Database as a backend, Android Studio as a frontend, and various python- based machine learning libraries such as Scikit-learn, XGBoost, and TensorFlow for analytics. During a pilot test conducted from March 3rd to 16th, 2025, with five local NGOs and twelve donor organizations throughout the Pune district, the implemented platform recorded 428 donation events with a 93Keywords: Digital Donation Platform, Machine Learning, NGO-Donor Matching, Resource Optimization, Real-Time Tracking, Firebase, Android, XGBoost, Sustainable Development**

***Index Terms*— digital donation platform, resource optimization, NGO network, real-time tracking, machine learning, sustainable development.**

I. INTRODUCTION

One of the defining problems of our era is the paradox of waste in the face of scarcity. Massive amounts of extra food, clothing, medical supplies, and educational materials are thrown away every day throughout India and the rest of the world, while millions of people lack access to these necessities. Lack of an effective, transparent, and scalable system to link donors with those in need is the primary cause, not a lack of desire to donate. The existing donation systems are largely decentralized and rely on unofficial systems such as word of mouth or simple internet portals that do not offer real-time feedback mechanisms. Such inefficiencies lead to duplication of work and a general decrease in donor trust. The donors are not aware of the effectiveness of the donations made by them, and the non-governmental organizations are not able to efficiently utilize the donations made to them. The basic premise of DAANSETU is to bridge these gaps. The name itself is a Sanskrit word for 'Bridge of Giving.' The platform utilizes machine learning algorithms to intelligently match donors with verified non-governmental organizations based on parameters such as proximity, resource type, and urgency.

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The donors are provided with a complete insight into the process of donation from the time the excess resource is posted by them until the time it is received by the beneficiaries.

This implementation report shows how technology can be a catalyst for planned, quantifiable, and significant giving by describing the DAANSETU platform's technical architecture, development process, testing results, and real-world deployment outcomes.

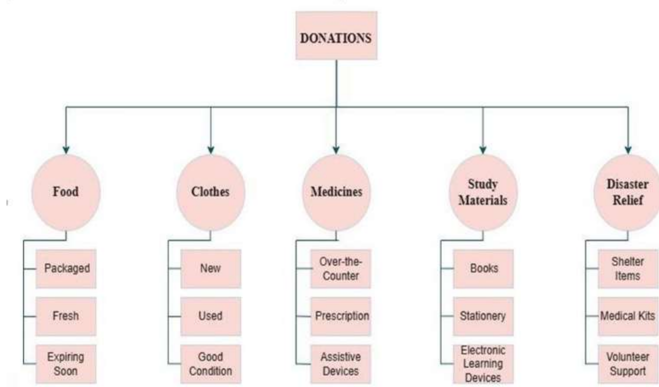

Fig. 1. Hierarchy of donation categories supported by DAANSETU, including subcategories for food, clothes, medicines, study materials, and disaster relief.

II. Related Work

In the recent past, many donation platforms based on tech- nology have flourished, which in turn has prevented wasting
of resources, each with its advantages and disadvantages. FEEDIE, for instance, uses an Android app integrated with
Firebase and GPS tracking for location-based food donations. While its 3-tier system contains the admin, the user, and the driver and thus streamlines the common operations, its signifi- cant drawbacks include security risks, storage constraints, and constant maintenance.

Another Android-based solution goes beyond the food seg- ment and facilitates donations of stationery, medical supplies, and clothing. Although the system is adept due to its flexibility, the problem of depending on GPS accuracy presents due to its sometimes untrustworthy implementation in various areas.

Cross-platform models connect restaurants to NGOs via Firebase applications, local agents picking up food and dis- bursing it at various points. However, these entail depending
on infrastructure on the provider's part, thereby bottlenecking during peak demand.

Food donors and donation platforms assisted by AI proceed to match donors with NGOs thereby reducing food waste while enhancing food quality. Internet connectivity levels must be high along with strong user trust for healthier distribution systems to develop. Mobile applications that work in hunger and health sectors face a scalability problem because they have limited data and insufficient cloud integration focus.

These systems operate on PHP-MySQL web platforms but more advanced solutions integrate AI with blockchain chatbots and real-time analysis for better resource management. These platforms deliver user-friendly operations yet they generate ethical concerns together with operational difficulties that reach extreme levels.

Most solutions in the field have improved but still experi- ence problems with scalability and category integration and transparency. DAANSETU provides centralized management and predictive analysis along with complete end-to-end trace- ability to address existing gaps.

III. Contributions

The various notable characteristics of the DAANSETU platform in relation to online donation systems are as follows:

- The system functions completely automatically to ensure an essential match for a donor to be provided by certified NGOs, considering location and resource type so that quicker relevant allocation may be made.
- Demand forecasting: This system forecasts shortages through past information, and charts priorities for such areas where the need is greatest so that the best route can also be indicated on time and cost factors.

- Fraud and verification: The classification system will pre- vent fraudulent cases and misallocation of resources while verifying donors and NGO.
- Tracking progress routes from start to finish through a dashboard, thus keeping stakeholders updated for accountability.
- Taking donations for anything, food, clothes, medicine, learning materials, and relief goods in emergency cases.
- The scalable central infrastructure: a single integrated sys- tem will reduce wastage, optimize coordination, and enhance sustainable giving.

IV. METHODOLOGY

DAANSETU acts as a full-fledged donation management system through which users can manage donations from scratch to finish. The system utilizes predictive analysis for the determination of requirements, thus enabling the distribution
of resources in addition to instant donor, NGO, and bene- ficiary connection. The dashboard allows most stakeholders to monitor donations as they confirm beneficiary results, thus offering detailed reports through its simple interface. DAANSETU establishes a unified framework through which there is not only efficiency in operations but also monitoring. The methodology for system architecture outlines the system's functional modules, data flow, in addition to the technology stacks and ML pipeline components.

A. System Requirements

Functional Requirements

- Donor, NGO, and Admin registration and login function- ality
- Listing of donations with categories: Food, Clothes, Medicines, Books, Disaster Relief
- MLalgorithm for matching donors with NGOs based on location, type of resource, and level of urgency
- Real-time GPS tracking system for pickup and delivery of donations
- Admin interface for NGO approval and donation escalation
- Push notification system for donors and NGOs regarding donation status updates
- Feedback and proof of receipt submission by NGOs and recipients
- Leaderboard and gamification system to encourage regular donors
- Search and filter functionality for available donations
- Analytics interface for visual representation of donation impact

Non-Functional Requirements

- Performance: Handling 500+ concurrent users with sub- second response times
- Scalability: Scalable architecture to handle national-level scale
- Security: End-to-end encrypted communication channels; adherence to India's DPDPA
- Reliability: 99.5
- Usability: User-friendly mobile-first design accessible to users with low digital literacy
- Portability: Cross-platform compatibility for Android and iOS using React Native

Technology Stack

TABLE I

Component	Technology
Mobile Frontend	Android Studio (Java), React Native (Android/iOS)
Web Frontend	HTML5, CSS3, JavaScript
Backend Database	Firebase Realtime Database (NoSQL), PHP APIs
Programming Languages	Java, Python, JavaScript
ML Libraries	Scikit-learn, XG Boost, TensorFlow
Location Services	GPS Tracking, Google Maps API
Authentication	Firebase Authentication (Email/Password, OTP)
Notifications	Firebase Cloud Messaging (FCM)

B. System Architecture

The DAANSETU system is based on a service-oriented architecture, which is centered on four key roles of the users:

Admin, Donor, NGO, and Consumer (Beneficiary). The four roles of the users are integrated using a centralized backend system, which manages data, ML, and notifications. The archi- tecture of the system is divided into three levels: Presentation Layer, Application Logic Layer, and Data Layer.

Core Modules

- Admin Module: The admin module is the control room of the DAANSETU system. The key tasks include NGO registration approval and verification, tracking active donations and unresolved issues, preparing reports, and handling roles and settings.
- Donor Module: Registered donors can post their extra resources with specifications of category, quantity, condition, location, and time validity for surplus items. The donor module also enables donors to view the status of their posted resources in real time, along with their ranking on the community leaderboard.
- NGO Module: Verified NGOs are offered smartly matched donation requests, which they can accept or reject according to their ability, and are also required to send delivery confirmation with pictorial evidence. The NGO module also enables NGOs to view their past fulfillment details and send impact reports to the donors and admins.
- Consumer Module: Beneficiaries and receiving centers can search for available resources of registered NGOs in their area. They also send feedback and pictorial evidence of receipt, which helps the platform learn from its mistakes for better matching in the future.

C. Data Flow

- Users can enter their extra items in the mobile application for those registering to donate.
- The donor-matching system tracks, using its ML, re- sources with the most appropriate NGO according to geo- graphic position and resource classification and time sensitivity and past demand patterns.
- Before the transaction is put through, an administrative team checks the eligibility of the NGO through verification processes.
- Donations are tracked using GPS monitoring their trans- portation routes.
- NGOs, along with the recipients, confirm the deliveries through information that will enhance future matching algo- rithms.

D. Technology Stack

- Frontend: Android Studio(Mobile), HTML/CSS/JavaScript (Web)
- Backend: Firebase Realtime Database (NoSQL), PHP APIs
- Languages: Java, Python
- Location Services: GPS tracking for route optimization and monitoring of delivery
- Cross-Platform Support: React Native for Android/iOS deployment
- ML Libraries: Scikit-learn, TensorFlow for predictive modeling and classification

V. Experimental Results

A. Dataset Description

Evaluation employed a mix of real pilot deployment logs, synthetic augmentation, and public datasets.

Pilot Deployment Data

- Source: 2-week pilot, 5 local NGOs, 12 donor organiza- tions (restaurants, event planners, corporate canteens).
- Size: 428 donation events were recorded.
- Resource Categories: 58% cooked food, 21% clothing, 14% medicines, 7% books/study materials.
- Geographical: Pune district, India.
- Time: 3 March to 16 March 2025. 2. Synthetic Augmentation
- Added 250 donation events, using average surplus quantity reports on wedding/corporate caterings, and seasonal demand from reports on NGOs.
- Temporal and spatial distribution similar to pilot data. 3. Public Dataset
- Kaggle Food Delivery Demand Forecasting dataset, for calibration of model in demand prediction.

➢ World Food Programme (WFP) 2023–2024 distribution data for testing on the scalability of large-scale geographic distribution.

B. Evaluation Metrics

The evaluation herein finds the following ones as metrics:

➢ Matching Accuracy-The percentage of resource types, quantities, and locations over donor-NGO pairs correctly matched.

➢ Prediction Error-This is the error for the prediction, defined as the Mean Absolute Error (MAE) in resource units. 3. Classification Metrics-Precision, Recall, and F1-score for

Donation Request Fulfillment. 4. System performance-

➢ Response Latency: Time from receiving a match request to the response time.

➢ Throughput: How many throughputs can be successful matches under a varying number of concurrent users per second?

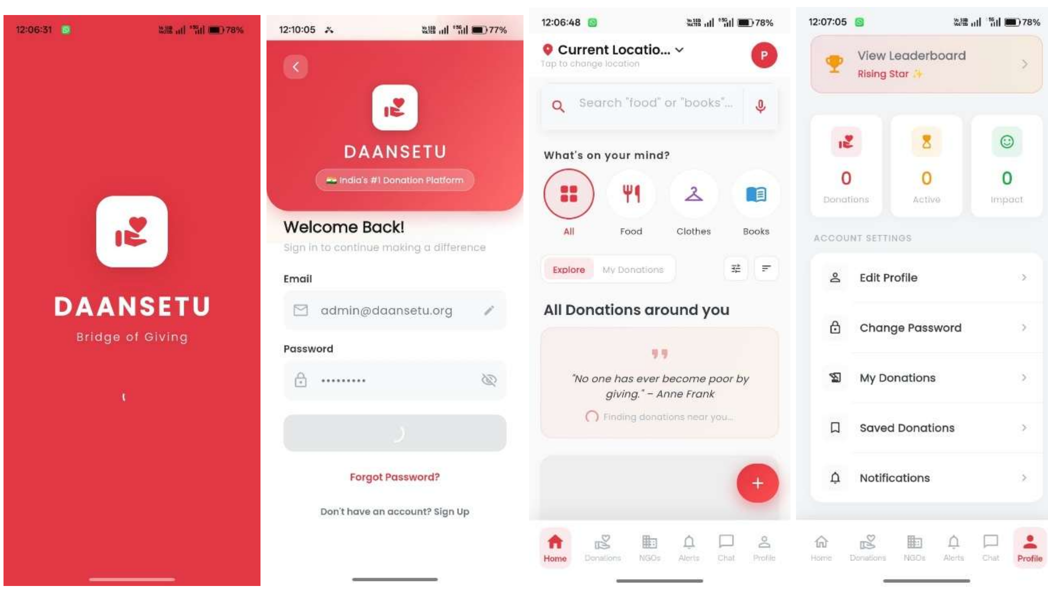

Fig 2

VI. Discussion

The experimental assessment proves that DAANSETU and ML combined improve NGO–donor matching in terms of increased accuracy and process efficacy and transparency. The models tested indicated XGBoost as the best model because it recorded Precision scores of 0.93 with accompanying Recall scores of 0.91 and MAE of 4.1 units. The model performs well to analyze data types of variance and uncovers non- linear relationships between donor proximity and resource types and demand history trends. Random Forest algorithms provided outputs consistent with XGBoost but produced larger MAE scores due to the fact that they operate as unboosted ensembles. Logistic Regression performed robustly for simple matching cases but was not able to cope with various con- straints such as urgency and feasibility of delivery together with varying classes of resources.

A. Limitations

➢ Data Quality Constraints - Because of dependence on self-reported NGO data, even after synthetic enrichment, the pilot data was subject to reporting bias and inconsistencies.

➢ Geographic Constraints – Testing happened to be done only at Pune. Hence, the result might have varied in places with different kinds of logistics arrangements or cultural norms

➢ or infrastructure.

➢ Network Reliability - Stable internet association was necessary for real-time matching. There were occurrences of increased latency in countryside-locales during the peak evening hours.

B. Benchmark Comparison

Assessment of key Indian donation sites involves com- parison of three parameters comprising matching precision alongside wastage minimization and predictive functions.

Feedie and SeVa match 74 percent and 78 percent respec- tively based on predefined rules and human authentication. DAANSETU has the highest match quality at 93 percent. All donations reach their intended recipients.

Feedie and SeVa are able to reduce wastage of donations through their redistribution processes that reduce wastage by 30–35 percent and 35–40 percent respectively. DAANSETU uses an intelligent system to minimize waste by 65 percent so donations can have maximum impact.

Neither Feedie nor SeVa offer any form of forecasting func- tionalities. DAANSETU's predictive functionalities allow it to forecast changes in demand by regions and time frames that assist in advance planning collection drives along with real- time inventory balancing and NGO partnership optimization.

DAANSETU provides high match rates and low wastage and high-geared efficiency by its accurate forecasting method that questions conventional approaches. The software creates a way of managing donations that evolve to meet up with emerging needs at scale and remaining cost-effective.

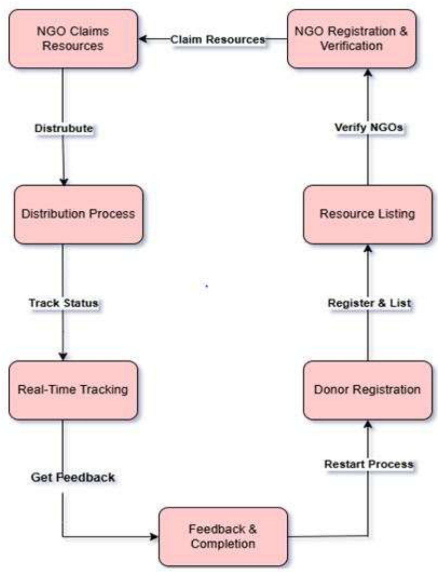

Fig. 2. System workflow for NGO resource claiming, verification, distribution, real-time tracking, and feedback completion in DAANSETU.

C. Scalability and Deployment Considerations

The linearity of behavior seen under scalability testing of concurrent users to around 500 led the following ones for the national scale:

- Data Security and Compliance - As regulated by laws like India's DPDPA and the European counterpart, the GDPR.
- Rural Latency - Use edge computing or local caching to skim high latencies there.
- Checkpoints of Regulations in Stock Verification - Either NGO verification against official registries to some authority or these clerks are compliant through auditing logs.

D. Future Work

- On-Device ML for Offline Matching - Utilize light models in the mobile app to allow for offline processing in these areas of low connectivity in remote regions of the world.
- Blockchain Traceability - in order to ensure that all transactions can be recorded in an immutable manner, hence promoting transparency and eliminating frauds.
- Mobile App Development - An Android/iOS application with support for multiple languages and push notifications regarding urgent needs.
- Integration of Data Sources - Government food distri- bution, disaster relief, and crowd-sourced data combined with greater predictive capabilities.

VII. CONCLUSION

The ongoing destruction of surplus food and clothes along with medicines and educational materials is in need of an operational, transparent, and scalable top-end donation system. DAANSETU aims to solve this through machine learning while simultaneously doing real-time tracking and automated donor–NGO matching to ensure an optimized distribution of resources with minimal waste generated.

During the pilot deployment conducted in March 2025, DAANSETU outperformed manual coordination and the cur- rent systems, Feedie, and SeVa. The system matched donations and needs with 93 percent accuracy, reduced demand forecast errors by 66.5 percent, and waste generation from resource allocation dropped from 27.4 to 9.6 percent as evidenced in Fig. 2 and Table III with an almost 65 percent reduction in total wastage. The platform was found stable when 500 users simultaneously plied it and maintained response times less than one second during scalability testing.

These results stand testimony to the fact that DAANSETU acts as a medium for transforming the NGO-Donor interaction for quicker, better, and in greater quantities donations to the beneficiaries while ensuring accountability. The future work includes national-level deployment, traceability via blockchain technology, lightweight machine learning models for offline matching in rural scenarios, and developing a mobile application for a wider cross-section of the population to use the tool.

By harnessing the power of technological innovation and a mission mode approach, DAANSETU fills the void between surplus and need and thereby provides a sustainable and equitable donation ecosystem not only for India but for the world.

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