

FoodShare : A Survey on Web-Based Food Donation and NGO-Coordinated Redistribution Platform

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Abstract - Urban food wastage and community food insecurity represent a significant socio-economic and environmental challenge. Although commercial food providers and house-holds generate substantial quantities of surplus edible food, conventional redistribution processes can be constrained by manual coordination, limited tracking visibility, and spoilage before collection. This paper presents a literature review of 22 selected studies examining technology-enabled food recovery and redistribution. The reviewed literature is organized across web and mobile redistribution platforms, geolocation-based matching, pickup and handover verification, AI-based food-quality assessment, IoT-enabled monitoring, offline operation, inventory management, and environmental and social considerations. The analysis identifies limitations related to connectivity, third-party service dependence, incomplete end-to-end traceability, synchronization, inventory reconciliation, beneficiary-level allocation, and disposal verification. Based on these findings, this paper proposes FoodShare-Sahyog Seva, a admin-istrators. The proposed architecture uses Next.js 14, Type-Script, Tailwind CSS, Supabase/PostgreSQL, Prisma ORM, and Recharts, with proposed capabilities including offline-, inventory tracking, NGO-assisted benefi-ciary allocation, waste-routing records, and operational analytics. The proposed system is a design framework and has not yet been presented as an implemented or experimentally validated system; therefore, its performance, security, accessi-bility, food-safety, and environmental benefits require future implementation and evaluation.

Keywords - Food donation, food redistribution, food waste management, NGO coordination, geolocation, pickup verifi-cation, progressive web application, inventory management, sustainability.

I. INTRODUCTION

Food loss and waste is a leading environmental and social problem. Research on surplus recovery, consumer-related food waste, and redistribution demonstrates the benefits of preventing avoidable waste and directing edible surplus to organizations and communities able to receive it [1, 2, 4]. Recovery and prevention are related but distinct interventions: redistribution can support food access, but does not

itself address the root causes of food insecurity [3, 4]. Conventional redistribution may depend on calls, text messages,

and face-to-face coordination. Digital services can structure these interactions, but their effectiveness relies on prompt communication, local logistics, and the capacity of receiving organizations [7, 15, 5].

The reviewed literature describes peer-to-peer shar-ing and web architectures using MERN, Django, Re-act/Supabase/PostgreSQL, PHP/MySQL, and RESTful services [5, 10, 7, 9, 15, 11]. Other studies examine loca-tion matching, computer-vision methods for food-quality assessment, IoT telemetry for storage monitoring, and OTP-or image-supported handover records [16-19, 12, 13]. Reported timing results, including matching and end-to-end redistribution times, are specific to the studies and should not be treated as general performance guarantees [10].

Reported operational limitations vary by implementation. Some systems describe local data capture during network outages, while others rely on third-party mapping, messag-ing, or analytics services; connectivity resilience and third-party dependence therefore assess-ment [14, 7, 11, 9, 18]. Recipient management, pickup valida-tion, and composting workflows also appear in the literature, but the reviewed descriptions do not consistently establish end-to-end [21, 18, 12, 13, 7, 22]. OTPs and photographs provide different types of handover evidence; neither alone verifies food safety. Environmental assessment also depends on assumptions about transport and displaced purchases [5]. Participation, remaining shelf life, receiving-organization capacity, and practical collection and distribution arrangements are relevant to system design [6, 8].

This paper synthesizes 22 selected studies on technology-enabled food recovery and redistribution, including software architectures, proximity matching, AI-based food-quality as-sessment, IoT monitoring, volunteer coordination, environ-mental impact, and social considerations. The synthesis in-forms a research-gap analysis and the proposed FoodShare-Sahyog Seva architecture. The proposed platform connects donors, NGO administrators, volunteers, beneficiaries, and system administrators, with offline data capture and synchro-nization, handover records, expiry and inventory monitoring, beneficiary allocation, composting records, and impact ana-lytics. The architecture uses Next.js 14, TypeScript, Tailwind CSS, Supabase/PostgreSQL, Prisma ORM, and Recharts. It is a design proposal, not a report of an implemented or validated system.

II. OBJECTIVES

The role of this review and proposed system design is to:

1. **Systematic literature synthesis:** To synthesize and categorize 22 selected studies on technology-enabled surplus-food recovery, including web and mobile platforms, artificial intelligence, and Internet of Things (IoT) applications.
2. **Technology and architectural comparison:** To compare software frameworks and architectures, including MERN, Django, React/Supabase, PHP/MySQL, and RESTful services, as well as location-based matching and delivery-verification methods.
3. **Existing-system workflow analysis:** To examine multi-actor coordination, donation-status workflows, and notification mechanisms described in food-redistribution platforms.
4. **Operational and technical limitations:** To assess reported constraints related to network connectivity, handover verification, third-party service dependencies, and the handling of food that degrades or expires.
5. **Evidence-based research gaps:** To identify qualified opportunities for offline-capable web applications, combined OTP and photo verification, embedded impact analytics, composting workflows, and downstream beneficiary tracking.
6. **Proposed system architectural framework:** To define the proposed FoodShare architecture using Next.js 14, TypeScript, Supabase/PostgreSQL, Prisma ORM, and Recharts, treating offline operation, auditability, analytics, composting, and beneficiary tracking as design objectives requiring implementation and evaluation.

III. LITERATURE REVIEW

This review combines 22 studies selected from the supplied research-analysis package, published between 2014 and 2026. It is a package-aided thematic review, not an exhaustive systematic search or meta-analysis. The studies are grouped by system architecture, location matching, handover verification, food-quality assessment, storage telemetry, connectivity, inventory routing, and socio-environmental considerations. Publication details and evaluation methods are not reported consistently. Claims that could not be independently verified against the underlying work are treated as reported claims, not established results. A feature not described in a paper is not assumed to be absent from that system.

3.1 Web and Mobile Food Donation and Redistribution Systems

The reviewed implementations describe PHP/MySQL applications, Django systems with mapping interfaces, MERN applications, and React/Supabase systems with database-driven updates [15, 7, 10, 9]. Thangadurai et al. describe a Node.js REST service backed by cloud records [11]. These studies show that coordination functions can be imple-

mented using different technology stacks; the available descriptions do not establish that one stack is faster, safer, or more scalable than another. Serve Surplus is described as a Flutter application, while Share meal uses an Android application with Firebase services and image capture [12, 13]. Native applications and browser-based systems offer different access and deployment characteristics. Their suitability depends on deployment context, implementation, user roles, and workflow status handling; no architecture alone guarantees reliable offline operation.

3.2 Donor-NGO Matching and Geolocation

Geolocation can help identify receiving organizations and support navigation or route display. Aahara Setu describes mapping with Leaflet, OpenStreetMap, and Nominatim; Thangadurai et al. use Google Maps services; other reviewed systems describe browser- or mobile-based location features [7, 11, 10]. Serve Surplus is reported to use the Haversine formula to assess listing proximity [12]. Haversine distance is a great-circle distance between two latitude/longitude locations; it does not calculate road distance, estimate travel time, or perform route optimization. Proximity is one factor in donor-NGO matching, not a sufficient selection rule. Capacity, food type, storage, transportation, and timing also affect suitability. Reported matching radii and evaluation conditions vary, so results should not be compared directly. FoodShare's proposed matching would consider distance alongside availability, declared capacity, food requirements, and pickup deadlines.

3.3 Pickup, Delivery Logistics, and Verification

The literature describes OTP confirmation for Serve Surplus, photo-supported delivery records for Share meal, and status changes or notifications in web systems [12, 13, 10, 9]. An OTP can associate confirmation with a transaction, while a photograph can document an item or handover stage. Neither alone establishes safe handling or a complete chain of custody. The supplied analysis reports 100% successful handovers for Serve Surplus, but the available description does not establish the measure's scope or provide enough detail to infer cryptographic security. Replay protection, identity confirmation, image origin, failed handovers, and exception handling are not sufficiently described. The reviewed systems do not establish a mandatory combined OTP-and-photo protocol. FoodShare's proposed flow would associate OTP confirmation, date and time, and a photograph with a transaction; correctness, privacy.

3.4 AI/ML-Based Food Quality Assessment

The reviewed studies investigate image-based freshness classification. Feed Bridge is described as using EfficientNetB0 transfer learning; Food Linker combines feature reduction with image classification; Sharebite describes a custom CNN [17, 16, 18]. The supplied analysis reports accuracy values of 95.92% for Feed Bridge, 98.65% for Food Linker, and 90-

91% for Sharebite, but these values have not been verified against the original evaluation sections. A sample count of 6,818 is also supplied without a clear correspondence to the other datasets and is not used as a comparative metric. Dataset composition, class labels, train/test conditions, and devices vary, so the percentages do not establish a comparative ranking. Sparse PCA is a dimensionality-reduction technique, not a classifier. Image assessment concerns visible appearance and cannot determine internal contamination, temperature history, or other food-safety conditions. A classifier cannot replace qualified human judgment or applicable regulations. Any future classifier would need documented datasets, independent validation, and a defined advisory role.

3.5 IoT and Food Storage Monitoring

Sharmitha and Karthikeyan discuss sensor-based food-storage monitoring and MQTT alerts [19]. The supplied analysis describes load-cell and ultrasonic sensors for estimating weight or fill level. These measurements may supplement manual inventory estimates, but do not establish edibility or cold-chain compliance. Temperature and quantity telemetry require validation. The reviewed platform summaries provide limited shared evidence on instrumented cold storage or in-transit telemetry. Sensor-based pilots also involve hardware, calibration, power, and maintenance costs [8, 9, 20]. FoodShare's proposed initial workflow therefore relies on recorded inventory fields and manual inspection; sensor integration remains a possible future step, not a current feature.

3.6 Offline Operation and Connectivity

Sandhiya et al. describe locally saved donation data and synchronization after connectivity is restored [14]. Share meal reports connectivity challenges, while Aahara Setu's mapping and notification services depend on network services [13, 7]. These examples support assessing connectivity resilience but do not establish that all existing platforms fail during outages. Offline data entry and online synchronization are distinct capabilities: a locally stored donation is not yet visible to an NGO or validated against authoritative inventory. The supplied analysis attributes Local Storage/IndexedDB and background synchronization to Sandhiya et al., but evidence about conflict resolution, idempotent retries, expired queued listings, and duplicate prevention is insufficient. FoodShare's proposed offline queue would require server-side reconciliation rules, visible pending states, and tests for simultaneous edits and resubmissions.

3.7 Inventory, Expiry, and Waste Routing

Inventory workflows must represent food type, quantity, availability, and relevant timeframes. Garrone et al. examine commercial surplus and recovery constraints associated with sell-by dates; Aschemann-Witzel et al. discuss date interpretation as one factor in consumer food waste [1, 2]. Aahara Setu and Swetha and Pavana include quantity and expiry-

related listing information [7, 9]. Such fields can support prioritization, but listing information alone does not reconcile reserved quantities, NGO receipt, beneficiary allocations, and remaining stock. Kumaravel et al. describe routes for edible food and material directed to biodegradable processing; Sharebite also describes a composting pathway [21, 18]. The literature therefore does not support claiming that composting has never been considered in food-donation software. The reviewed evidence does not consistently demonstrate end-to-end, automatically verified disposal records. FoodShare proposes recording the reason for removal, quantity, authorized decision, receiving facility, and disposal confirmation as an inventory and traceability extension, not as a validated waste-reduction result.

3.8 Sustainability and Social Considerations

Makov et al. analyze peer-to-peer sharing transactions and lifecycle impacts, with assumptions about transport and the extent to which shared food displaces purchases [5]. The supplied analysis reports about 170,000 OLIO listings, a collection rate of approximately 60%, and approximately 90 tonnes collected; the study's life-cycle assessment depends on stated assumptions and system boundaries [5]. Ebon-ica Saleth et al. report redistribution and environmental measures, but the supplied analysis notes inconsistencies in the 78% figure, reported food mass, emissions totals, and conversion factor [20]. These figures should not be transferred directly into FoodShare carbon estimates. Mourad distinguishes recovery from prevention and cautions against treating donation as equivalent to reducing surplus at its source [3]. Davies discusses mobility, justice, and recipient dignity, while Devaraj and Balasubramanian examine organizational factors in hospitality-sector donation [4, 6]. Khan et al. review tracking and infrastructure concerns in household-to-NGO systems [22]. These sources make access, transport, organizational capacity, privacy, and beneficiary choice relevant alongside transaction efficiency. FoodShare's proposed beneficiary records would be NGO-assisted and access-controlled; their suitability requires assessment with participating organizations and recipients.

IV. COMPARATIVE ANALYSIS

Table 1 synthesizes 22 selected studies. "Not reported" marks unavailable details; a dagger marks package-reported claims not independently checked against accessible evaluation sections. The studies use different designs and measures, so their results are not directly comparable.

Table. 1: Comparison of the 22 selected studies: technologies, evidence, and limitations.

Ref.	Year	System/Study	Technology	Main Function	Method / Algorithm	Key Result	Limitation
[1]	2014	Garrone et al.: upstream recovery	Supply-chain case-study framework	Identify surplus and recoverability	Multiple case studies of 83 firms	Internal sell-by deadlines are important upstream surplus drivers.	Italian manufacturing/retail setting; original package misstates venue and sector counts.
[2]	2015	Aschemann-Witzel et al.: consumer waste	Literature and expert interviews	Explain waste-related behavior	Review and qualitative synthesis	Planning, handling, motivation, and date interpretation interact.	No platform evaluation; no evidence that date confusion is universally the primary cause.
[3]	2016	Mourad: prevention, recovery, recycling	Comparative policy analysis	Distinguish sustainability interventions	Interviews and observations in France/US	Recovery and source prevention pursue different objectives.	Context-specific policy evidence; software performance is not evaluated.
[4]	2019	Davies: waste and justice	ICT-mediated business-to-charity setting	Examine mobility and access	Mobile ethnography	Logistics efficiency alone does not establish food justice.	Context-bound qualitative findings; supplied interview count is not confirmed.
[5]	2020	Makov et al.: OLIO analysis	P2P application; MATLAB analysis	Measure exchanges and environmental effects	Transaction analysis; Monte Carlo; LCA	About 170,000 listings; 60% collection; approximately 90 t collected.	Estimated item weights, location proxies, and purchase-displacement assumptions.
[6]	2025	Devaraj and	Survey/statistical analysis [†]	Examine donation-system adoption	Practitioner survey [†]	Package reports 300 respondents and collaboration-related associations [†] . Tested functions described as successful; receiver requests also documented.	Regional, cross sectional evidence coefficient interpretation requires full-text checking. Test-suite denominator and field reliability not established; ML forecasting is future work.
[7]	2025	Bala subramanian: hospitality AaharaSetu	Django; Leaflet; geocoding; SMS/email	Donor-NGO receiver coordination	Prototyping; functional/integration tests		
[8]	2026	Shivani and Usha: web redistribution	Three-tier web architecture	Listings, alerts, and coordination	Prototype evaluation	Qualitative improvement reported. Numerical timing: Not reported in the reviewed source.	Evaluation size and numerical comparison are not established.
[9]	2026	Real-time NGO notification system	React; Tailwind; Supabase; PostgreSQL; Power BI	NGO alerts and donation tracking	Functional donation scenarios	Real-time updates and dashboards described. Alert latency: Not reported in the reviewed source.	Quantitative field outcomes absent; QR, AI, IoT, and mobile extensions are future work.
[10]	2025	MERN redistribution platform	MongoDB; Express; React; Node; geolocation	Coordinate listings and pickup	Scenario testing	Package reports posting < 1 min, matching 2–3 min, and completion about 25 min [†] .	Controlled scenarios; benchmark sample and broader transferability require checking.
[11]	2026	Smart Food Donation and Waste Reduction System	Web interface; cloud records; map API; REST	Match donors with nearby NGOs	Location matching	Centralized coordination described. Numerical distance/timing benchmark: Not reported in the reviewed source.	API/cloud dependence; reproducible evaluation detail is limited.

[12]	2025	Serve Surplus	Flutter; Node; OTP [†]	Proximity matching and handover	Haversine matching	Package describes donor/receiver proximity bounds and OTP confirmation. Rider coordination and image-supported completion	Full text and publication details require verification; no retained absolute security claim.
[13]	2025	Share meal	Android Studio; Java; Firebase	Donor-rider-recipient handover	Images, maps, status updates	described. Numeric benchmark: Not reported in the reviewed source.	Connectivity/data integrity concerns; photo evidence does not establish food safety.
[14]	2026	Offline-capable web donation platform	HTML/CSS/JS; Node/Express described	Save listings during outages	Local saving and later synchronization	Offline data-entry behavior described. Sync success rate: Not reported in the reviewed source.	Database descriptions vary; IndexedDB /service worker details and conflict rules not confirmed.
[15]	2024	PHP-based donation project	PHP; MySQL; browser technologies	Separate coordination roles	Role-oriented prototype	Donor, NGO, administrator, and delivery activities described. Numeric benchmark: Not reported in the reviewed source.	Web/Android descriptions are mixed; load and permission-isolation evidence is limited.
[16]	2026	Food Linker	MERN; Tensor-Flow/Open CV; notifications	Quality advice and redistribution	Sparse PCA-assisted learning	98.65% test accuracy; 85.89% feature reduction; 22 ms inference	Dataset partition, hardware, and independent test conditions require verification.
[17]	2025	FeedBridge	EfficientNetB0; web stack; hybrid DB	Freshness assessment and matching	Transfer learning	Package reports 95.92% validation accuracy on 4,800 images.	Full text, author order, publication details, and benchmark conditions require verification.
[18]	2026	Sharebite	CNN; cloud stack; SMS	Accessibility, freshness, waste routing	CNN classification	Package reports 90–91% validation accuracy on 5,000 images.	Model protocol and landfill reduction baseline are not independently confirmed.
[19]	2021	IoT food-wastage framework	Sensors; MQTT; server/application components	Caterer quantity monitoring	Threshold-triggered alerts	Quantity-monitoring and refill/surplus-alert workflow described. Sensor error: Not reported in the reviewed source.	No comparable temperature, cold-chain, or beneficiary-ledger evaluation.
[20]	2025	Zero-impact redistribution pilot	Predictive ML; Hyperledger Fabric; sensors; EVs	Redistribution and carbon accounting	Six-month pilot; claimed LCA	Results table reports 112.4 t redistributed; 78% redistribution share.	78% definition conflicts with abstract; carbon arithmetic is internally inconsistent.
[21]	2026	Food Waste Management System	Cross-platform approach; roles; location workflow	Donation and biodegradable routing	Workflow-oriented development	Edible/non-edible pathways discussed. Disposal validation rate: Not reported in the reviewed source.	Spoiled-food routing uses forward-looking language; relies on manual entry.
[22]	2024	Household-to-NGO review	Literature-based analysis	Identify tracking/infrastructure issues	Comparative review	Describes recipient notification and tracking, scalability, and logistics concerns.	Secondary evidence; systematic search protocol and supplied 30+ count not established.

4.1 Software Technologies and Architectural Frame-works

The studies describe listing, acceptance, notification, and collection workflows implemented with relational web frame works, JavaScript stacks, and managed cloud services [7, 15, 10, 9]. These platforms differ in architecture and deployment options. Architecture labels alone do not establish maintainability, security, scalability, or speed; functional demonstrations do not replace concurrent load testing or evaluation of NGO operations. FoodShare's proposed stack overlaps with systems using React, Tailwind, Supabase, and PostgreSQL, but the complete proposed architecture has not been implemented or evaluated [9].

4.2 Spatial Matching and Handover Protocols

Coordinate filtering, Haversine ranking, map visualization, and road-routing assistance address different needs and use different information [12, 7, 11]. The approximately 25-minute redistribution cycle reported for Karanth et al. is a study-specific scenario result, not a general performance benchmark [10]. Meaningful comparison would require consistent service areas, volunteer availability, baselines, and measurement methods. The same caution applies to OTP records, photographs, and status updates [12, 13, 10]. None alone establishes food safety or complete custody. Handover completion, authorization, and inventory accuracy require separate assessment.

4.3 AI/ML Assessment and Network Resilience

The reviewed AI systems use different datasets and tasks, so reported accuracy values cannot be compared directly [16-18]. A classification score does not establish a safe to eat determination. Sandhiya et al. describe offline data storage and later synchronization, but the reviewed account does not specify conflict resolution or retry behavior [14]. This should not be confused with reliable multi-user synchronization. FoodShare would need to test queued updates, duplicate submissions, stale listings, and server reconciliation.

4.4 Inventory Lifecycle, Waste Routing, and Impact

The reviewed systems describe recipient requests, quantities, and recipient records [7, 13, 22]. The available evidence is less consistent about linking an NGO-received batch to reservations, actual disbursements, and remaining stock. Waste-routing descriptions do not by themselves prove that material was composted or that disposal was completed [21, 18]. Environmental indicators also require explicit validation and stated accounting limits; they cannot

be inferred from a visualization tool or a general conversion factor [5, 20].

V. RESEARCH GAP

The reviewed studies span peer-to-peer sharing, role-based web and mobile systems, image-based food assessment, and recipient requests, OTPs, local data storage, and composting have been described. The opportunity identified here concerns integration, lifecycle consistency, and evaluation; it does not imply that each feature is absent from prior systems.

5.1 End-to-End Integration across Multiple Roles

Existing systems describe donor, NGO, recipient, administrator, and delivery-partner functions, including role separation and notification workflows [7, 9, 15]. The reviewed descriptions do not consistently establish a shared, traceable audit trail from a donation listing through volunteer custody, NGO intake, stock records, beneficiary distribution, and final dis-position. FoodShare proposes representing these events with explicit states and batch-level records under role-based authorization. Operational completeness and usability would require assessment with participating organizations.

5.2 Donor-NGO Coordination and Geolocation

Location-based matching, map services, and Haversinebased proximity filtering are reported across several systems [7, 11, 12]. The evidence is less consistent on whether matching jointly accounts for distance, food eligibility, recipient capacity, volunteer availability, collection deadlines, and fallback when an organization does not respond. Haversine filtering estimates straight-line distance; it does not provide road routes, travel times, or a complete cost-free infrastructure. FoodShare treats eligibility-aware ranking and fallback rules as design choices to be tested.

5.3 Pickup Verification and Handover Security

OTP confirmation and photo-supported records appear in the reviewed systems [12, 13]. The evidence does not establish the security, reliability, usability, or privacy implications of requiring both. FoodShare may assess a combined work-flow with transaction timestamps and exception handling. OTP and photo evidence do not guarantee food safety; security depends on application controls, authorization, audit handling, and field procedures.

5.4 Offline-First Operation and Synchronization

Local saving and later synchronization are described in one reviewed web system [14]. Evidence is limited on conflict handling, duplicate retries, simultaneous claims, queued-listing expiry, and server-authoritative inventory. FoodShare proposes an offline-capable workflow that distinguishes pending local actions from server-confirmed records. Its reliability would require testing before background synchronization could be treated as dependable.

5.5 Inventory Lifecycle and Expiry Handling

Prior work describes commercial expiry dates, expiry related donation fields, and sensor-based quantity monitoring [1, 9, 19]. The reviewed accounts vary in their treatment of batch reservations, expiry-state transitions, quantities on proposes visible inventory levels and time-bound alerts with human oversight; eligibility should not be determined solely by a date field or automatic status change.

5.6 Beneficiary-Level Allocation and Dignity

Recipient requests and records appear in the reviewed literature [7, 13, 21, 22]. A remaining design concern is recording allocations without unnecessarily exposing demographic information. FoodShare proposes NGO-assisted allocation with access restrictions and privacy review, to be developed with stakeholders and assessed for accessibility and dignity [4].

5.7 Waste Routing and Composting Records

Kumaravel and Sharebite describe routes for edible food and composting [21, 18]. The available evidence is less clear about an auditable record of items accepted and processed by a facility. FoodShare proposes recording the cause, quantity, authorization, destination, and confirmation of final disposal. This is a traceability objective, not a claim of zero landfill waste or automatic diversion.

5.8 Impact Analytics and Carbon Accounting

The reviewed literature includes transaction-based lifecycle assessment and environmental reporting [5, 20, 3]. Reported pilot figures have limitations, and a single transferred factor is not justified by the available evidence. FoodShare proposes visualizing operational data and, if environmental estimates are included, stating system boundaries, factors, transport assumptions, and uncertainty. A charting library cannot validate an impact calculation.

5.9 Accessibility Across Web and Mobile Systems

The literature describes mobile and web applications and an SMS fallback [11, 13, 18]. A progressive web application does not by itself ensure device access, universal accessibility, reliable offline use, or access for people without smartphones. FoodShare proposes a responsive, NGO-assisted approach that considers language, privacy, connectivity, and volunteer workload.

VI. PROBLEM STATEMENT

Food businesses, shops, caterers, households, and local communities may use digital platforms to coordinate surplus collection and distribution within time and capacity constraints [1, 6, 4]. Existing systems describe matching, notifications, and some handover functions, but the reviewed evidence does not consistently show how records link pickup, NGO

receipt, inventory changes, beneficiary allocation, and final disposal [7, 9, 10, 21]. Local saving is also described in the literature, while the combined treatment of OTP and photo evidence, synchronization conflicts, and inventory validation remains unclear. Inventory and composting are mentioned, but reconciliation and completion of quantities are not consistently established [21, 18].

The engineering problem is to develop and evaluate an accessible web workflow with authorized, quantity consistent, reviewable records across stakeholders, including during connectivity loss. The proposed scope includes coordinated matching, handover verification, offline data capture, inventory, beneficiary allocation, waste routing, and transparent analytics. Environmental or social benefits are not assumed before implementation and evaluation.

VII. PROPOSED METHODOLOGY

The following workflow is a proposed design, not evidence of implementation or evaluation. It prioritizes an auditable operational core. AI classifiers, physical sensors, blockchain infrastructure, electric fleets, and external SMS providers are not included in the initial proposed stack.

7.1 System Architecture

The proposed presentation layer uses Next.js 14, TypeScript, and Tailwind CSS. A service worker would cache application-shell assets, while IndexedDB would hold drafts and queued operations. Server actions or route handlers would validate requests and apply matching, verification, inventory, and synchronization rules. Supabase Auth, PostgreSQL, protected object storage, and authorized Realtime subscriptions are proposed for identity, records, media, and updates. Prisma would access application tables from the server, and Recharts would display aggregated operational indicators. This architecture draws on role-based web workflows and partial stack overlap described in the literature [7, 9, 15].

The proposed data model includes organizations, memberships, donations, batches, assignments, handover challenges, verification records, stock movements, beneficiary allocations, disposal records, and audit events. PostgreSQL row-level security (RLS) and storage policies would supplement server-side authorization. A direct Prisma database connection does not automatically inherit a browser user's Supabase JWT; Prisma mutations would therefore enforce authorization server-side, with privileged credentials kept server-only. Schema migrations and managed authentication and storage tables would have clearly separated ownership. Library versions, deployment arrangements, and authorization boundaries require validation before implementation.

7.2 User Roles

Donors would create listings, provide relevant food and handling details, and view authorized status updates. NGO administrators would review suitability, accept donations, assign volunteers, confirm intake, manage stock, and record allocations or disposal. A system administrator would manage organizational approval and platform support functions. Volunteers or social workers would have restricted access to designated pickups and permitted field notes. These roles reflect actor separation described in web and rider-oriented systems [15, 13].

Beneficiaries could request or receive allocations through

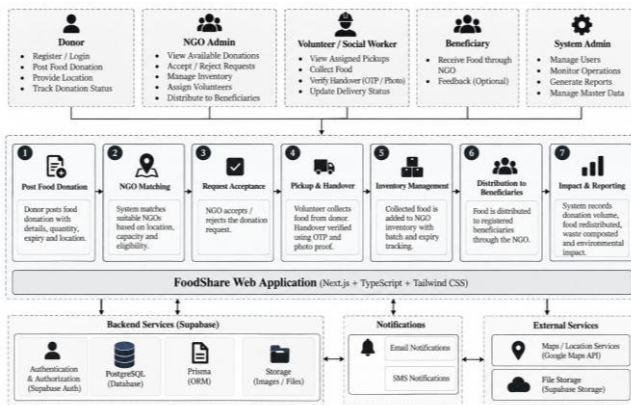


Fig. 1: Proposed System Architecture for FoodShare. This is a design proposal, not an implemented or experimentally validated deployment.

an NGO-assisted workflow. A personal account would be optional rather than a requirement for receiving food. Public dashboards would not reveal beneficiary identities, addresses, or dietary information. Operational traceability would be separated from public visibility, reflecting social considerations in the reviewed literature [4, 6].

7.3 Security and Role-Based Access Control

Supabase Auth is proposed as the identity provider. Authenticated sessions would identify the acting account; each protected operation would also verify the user's role, organization membership, and assignment. A valid session alone would not grant access to every record. Database and storage RLS policies would be tested alongside server-side authorization, including cross-organization reads, updates, and uploads. Secrets and service-role credentials would remain on the server. The implementation would document how authenticated identity is propagated to each data-access path, particularly where Prisma is used, and would not rely on RLS alone through a privileged connection without user-scoped context.

7.4 Donation Management

A donation record would include the donor, food category, description, quantity and unit, preparation or packaging details, and, where applicable, pickup location, pickup window, labelled dates, and a donor-declared handling deadline. Timestamps would use a consistent time-zone interpretation. Missing or uncertain safety-related information would require review rather than presumed acceptance. A commercial sell-by date would remain distinct from a donor-declared handling deadline; a generic expiry field would not silently replace these meanings [1, 2].

The proposed status flow is Draft, Pending, Available, Matched, Assigned, Picked Up, In Transit, and Received. A pickup would move the item into transit; partial pickups would record actual quantities and corresponding batch movements. Rejection, cancellation, no-show, and handling-deadline failures would follow explicit exception paths and preserve history. Receipt by an NGO would not be treated as beneficiary distribution. These are proposed workflow semantics, not claims that reviewed systems already implement them [10, 9].

7.5 NGO Matching

FoodShare would screen candidate NGOs by validated registration, supported food categories, current acceptance status, capacity, service area, and possible pickup window. For eligible candidates, initial proximity ranking would use the Haversine formula, following the matching concept described for Serve Surplus [12]:

$$\eta = \sin^2\left(\frac{\Delta\phi}{2}\right) + \cos(\phi_D) \cos(\phi_N) \sin^2\left(\frac{\Delta\lambda}{2}\right)$$

$$d_{DN} = 2R_E \operatorname{atan2}\left(\sqrt{\eta}, \sqrt{1-\eta}\right) \quad (1)$$

Here, ϕ_D and ϕ_N denote donor and NGO latitudes, $\Delta\phi$ and $\Delta\lambda$ are angular differences in radians, and R_E is the chosen Earth-radius approximation. The result is a straight-line distance, not road distance or arrival time. Units and numerical bounds would be reflected in implementation.

NGOs would confirm acceptance before volunteer assignment. An atomic reservation would prevent multiple organizations from claiming the same available quantity. Acceptance timeouts and cancellations would release reservations through recorded transitions. Matching thresholds would be configured and validated with participating NGOs rather than copied uncritically from another application's reported radii.

7.6 Pickup Status

For each handover accepted by the application server, the proposed design would create a transaction-specific

challenge. A six-digit donation handover code would be distinct from Supabase sign-in OTPs. The donor would retain the code until handover to the assigned volunteer. Where permitted, a food-focused photograph could accompany the record. The design would bind the challenge to the donation and assignment, enforce expiry and attempt limits, prevent replay, protect verification data, and consume each challenge once on the server. Audit records could distinguish device capture time, upload time, and server-confirmed completion time. Photographs would follow consent and retention requirements and would avoid identifying beneficiaries. A separate receiving acknowledgement would complete NGO custody. Neither OTP acceptance nor image submission would certify food safety [12, 13].

7.7 Offline-First Operation

The proposed browser client would cache the application shell with a service worker and store limited drafts and queued updates in IndexedDB. Local records would be acceptance, stock allocation, and authoritative completion would require server verification. Offline operation would not provide live maps, new assignments, or real-time alerts. Each queued operation would carry an idempotency key. Adjustments would require a reason and an authorized actor. Available stock would exclude reserved and quarantined quantities. Constraints would prevent negative balances and allocations above eligible availability. Units would not be combined without a defined conversion. Priority would be based on relevant handling deadlines, with alerts before re-view is needed. Past-due or otherwise ineligible lots would be quarantined from human-food allocation pending authorized review [1, 18].

7.8 Inventory Management

Inventory would be represented by received batches and an explicit movement log, rather than inferred from the latest listing. For each quantity unit, the proposed on-hand balance

$$q_{\text{onhand}} = q_{\text{received}} + q_{\text{adjusted}}$$

7.9 Beneficiary Management

NGOs would manage requests and allocations using the minimum information needed for intake and distribution, such as an internal identifier, household or group category where appropriate, and relevant dietary limits. Beneficiary profiles would not be public. An allocation would link the receiving NGO, batch, quantity, recipient or recipient group, date, and responsible worker to the inventory record rather than replace the donor listing. Duplicate-record review and assisted intake would be developed with NGOs. Reported beneficiary counts would distinguish persons, households, institutions, and distribution events. Access, retention, consent, privacy, and usability would be considered with stakeholders [4,

7, 13, 22].

7.10 Waste Routing

After authorized review, eligible food would remain available for human distribution. Material routed to an authorized composting facility or other organic-processing partner would have its batch, quantity, reason, authorizing role, intended facility, collection status, and receipt recorded. "Disposal requested," "facility received," and "processing confirmed" would be separate states. Missing confirmation would remain visible. An expired item would not automatically be treated as composted, and a facility receipt would not by itself prove processing or establish that landfill disposal was avoided. This proposed traceability workflow draws on waste-routing concepts in the literature and is not a demonstrated FoodShare result [21, 18].

7.11 Analytics

Recharts dashboards would display server-confirmed operational measures, including posted and accepted donations, completed pickups, NGO receipts, confirmed distributions, remaining stock, overdue reviews, cancellations, and disposal status. Views could be grouped by donation status and food category to support discussion of recurring surplus and distinguish prevention from recovery [3]. Choosing Recharts rather than a Power BI add-on described in another system is an implementation choice, not evidence of improved environmental validity [9].

Environmental estimates would use versioned, independently justified factors and disclose the baseline disposal pathway, food categories, displacement assumptions, transport and storage emissions, and uncertainty. Carbon offsets would be accounted for separately from avoided emissions. No calculated total would be presented as quantified savings, carbon-neutral status, or an ISO-compliant result without the corresponding assessment. The reviewed analyses support careful accounting, not a universal constant for FoodShare [5, 20].

7.12 Future Implementation and Evaluation

Implementation would proceed from authorization and the donation ledger to matching, assignment, handovers, inventory, allocation, offline reconciliation, and dashboards. Functional and integration tests would cover valid and invalid state transitions, concurrent claims, duplicate submissions, challenge replay, unauthorized cross-NGO access, partial pickups, stock adjustments, quarantine, and failed synchronization. Test cases would be defined in advance. No test pass rate or implementation result is claimed in this paper.

A potential stakeholder pilot would use a defined baseline and compare the proposed workflow under comparable service conditions. Measures could include listing-to-

acceptance time, pickup completion, verification completeness, duplicate or conflicting synchronization events, inventory discrepancies, and confirmed allocation quantities. Results would report sample sizes, follow-up duration, missing observations, and uncertainty. NGO and volunteer usability, assisted beneficiary access, and privacy-related exceptions would also be evaluated. Environmental analysis would be a separate study with stated boundaries. Any future AI component would require a suitable dataset and error analysis before deployment.

VIII. CONCLUSION

This review covers 22 articles on web and mobile coordination, geolocation, handover records, image-based quality assessment, sensor monitoring, inventory practices, and sustainability. The studies use different evaluation designs and measures. The approximately 25-minute redistribution cycle reported for Karanth et al. is a scenario-specific result, while environmental assessments depend on their stated boundaries and assumptions [10, 5, 20]. AI classification scores likewise cannot be compared directly across different datasets and test conditions.

The literature describes recipient workflows, local data saving, handover records, and composting pathways. A research opportunity is to evaluate how these functions can be linked through reliable synchronization, batch-level custody and stock records, beneficiary allocation, disposal confirmation, and transparent impact accounting. These are integration and evidence gaps; they do not show that the individual features are absent from prior systems [7, 14, 13, 21, 18].

FoodShare proposes a web-based architecture using Next.js 14, TypeScript, Tailwind CSS, Supabase/PostgreSQL, Prisma, and Recharts. Its intended workflow includes eligibility-aware matching, offline-capable field entry, transaction-linked pickup verification, inventory tracking, NGO-assisted beneficiary allocation, and documented waste routing. These remain design proposals, not implemented or experimentally validated features. Implementation and stakeholder review, authorization and synchronization testing, and field evaluation are required before conclusions can be drawn about redistribution performance, accessibility, food safety, or environmental impact.

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