RFID & AI-Powered Lost and Found System

An Innovative Solution for Public Spaces

Meet The Team

SHIVAM TRIPATHI

KUSHI SINGHAL

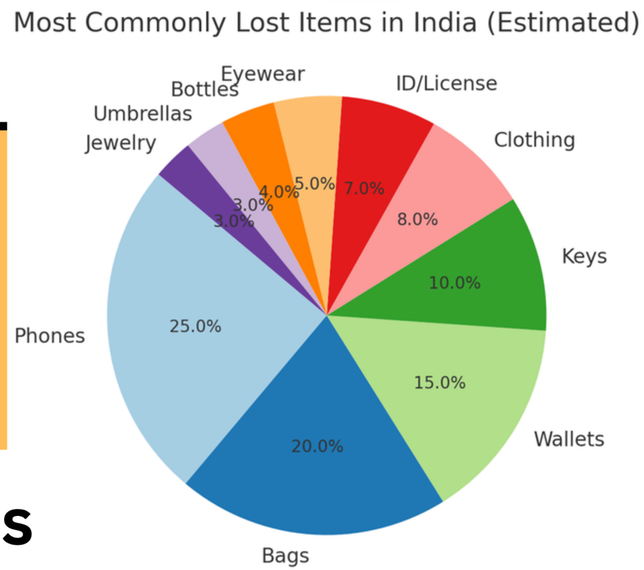
HARSHVARDHAN SINGH

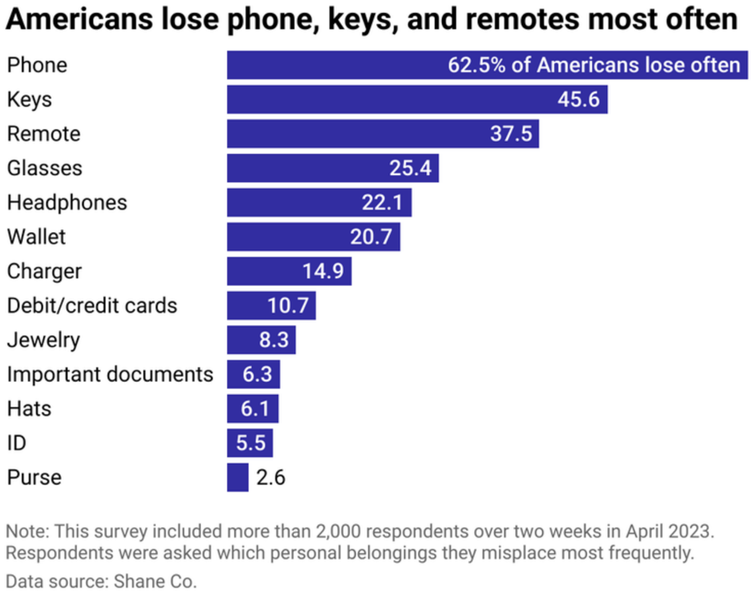
MANYA

The Problem – Lost Items in Public Spaces

- Every year, millions of items are lost in public places, causing inconvenience and security concerns.
- Common Lost Items: Phones, wallets, bags, documents, keys, ID cards.
- Key Statistic:
- India Data: Delhi Railway Stations recovered ₹1.2 Cr worth of lost baggage in 2023.
- Kochi Metro recovered 1,565 items, with umbrellas being the most common.
- 70% of lost phones are never returned.

- Challenges with Existing Solutions:
- Manual, time-consuming processes.
- No real-time tracking or automated matching
- Lack of a centralized system across locations.





Three key Statistics

Airport Statistics

- Over 2 million items are lost in airports every year.
- The most commonly lost items in airports include phones, passports, and laptops.
- Approximately 70% of items lost in airports are returned to their owners.
- JFK airport in New York City has the largest lost and found department in the world, with over 30,000 items reported lost every month.

Hotel Statistics

- 1 Hotels receive an average of 100 lost and found items every month.
- The most commonly lost items in hotels include clothing, chargers, and toiletries
- Hotels also have strict procedures for handling lost and found items, which include documenting, storing, and attempting to contact the owners of the lost items.

Public TransportationStatistics

- Over 400,000 items are lost in public transportation every year.
- The most commonly lost items in public transportation include phones, wallets, and keys
- Public transportation services have procedures in place for handling lost and found items, which include tracking, documenting, and storing the items in a secure location.

Existing Solutions & Their Limitations

- **Comparison of Current Systems:**
- **Manual lost & found logs (slow, unstructured).** ❌
- **CCTV footage tracking (inefficient & not scalable).** ❌
- **Barcode-based tracking (requires scanning but lacks AI matching)** ❌

- **Why These Are Not Enough?**
- **No real-time tracking.**
- **High dependency on security personnel.**
- **No automated matching for lost and found items.**

Solution	Use Case	Limitations
Manual Tracking	Small-scale operations	Labor-intensive, error-prone, no real-time visibility
Barcode Systems	Retail, warehouses	Line-of-sight required, limited data storage
Basic RFID Systems	Supply chain, asset tracking	No predictive analytics, high upfront costs
GPS Tracking	Fleet management	High cost, ineffective indoors, limited battery life

Real-World PROBLRMS:

Warehouse inventory discrepancies due to manual errors.
Retail checkout delays due to barcode issues.
Logistics companies unable to optimize routes.
Construction companies struggling with indoor tracking.

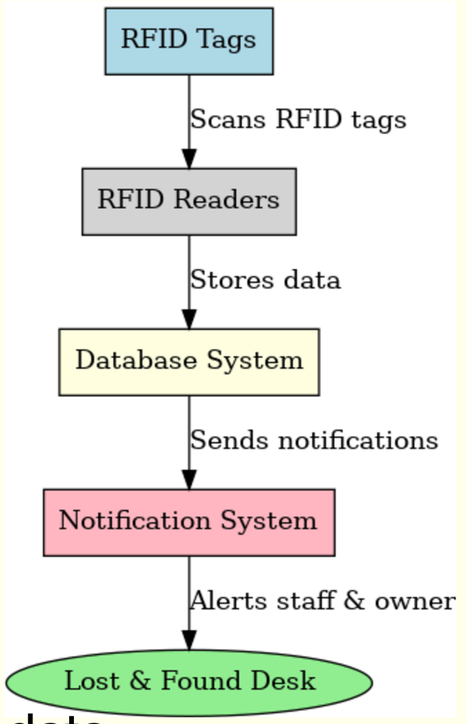
The Proposed Solution – RFID & AI-Based Tracking

Our solution combines RFID technology and AI-powered analytics to enable real-time tracking, monitoring, and optimization of assets, inventory, or processes.

RFID Tags: Attached to valuable items for real-time tracking.
AI Matching Engine: Uses ML-based text and image analysis.
Automated Notifications: Alerts users when their item is found.
Web/Mobile Portal: Allows users to report and track lost items.

Real-time visibility.
Improved efficiency.
Predictive maintenance.
Scalable and cost-effective

High-level architecture diagram



Tech Involved:
RFID Sensors & Readers – Detect tagged lost items.
Computer Vision (AI) – Matches item images with found reports.
NLP (Natural Language Processing) – Matches text-based item descriptions.
Cloud Database (Firebase/AWS) – Stores lost and found data.
Web & Mobile App (React/Flutter) – User interface for reports & tracking.

How It Works (Simple Flow)
Step 1: RFID tags and sensors collect data.
Step 2: Data is sent to the cloud for processing.
Step 3: AI analyzes data and generates insights.
Step 4: Insights are delivered via dashboards or APIs.

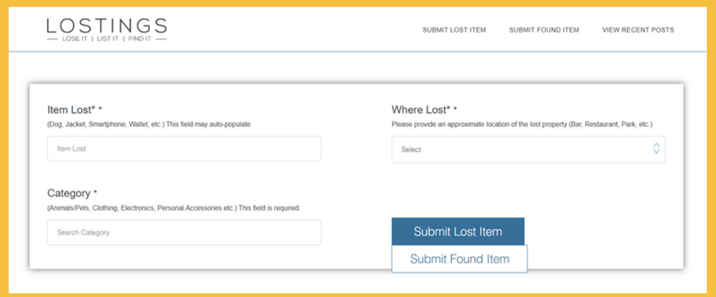
Technology Stack & Implementation

3 Layer Architecture

Application Layer |
| - UI, APIs, Alerts

Cloud Layer |
| - Storage, AI/ML

Edge Layer |
| - RFID, Sensors



Implementation Approach

Phase 1: Deploy RFID readers and sensors at key locations (e.g., warehouses, retail stores).

Phase 2: Set up cloud infrastructure (e.g., AWS/Azure) and data pipelines for seamless data flow.

Phase 3: Develop AI/ML models for predictive analytics and deploy them in the cloud.

Phase 4: Build user interfaces (e.g., dashboards) and integrate with existing systems (e.g., ERP, CRM).

Frontend:

Web/Mobile App: React (Next.js) / Flutter

UI Framework: TailwindCSS / Material UI

Backend:

Server: Node.js (Express) / Python (FastAPI)

Database: Firebase Firestore / PostgreSQL

Cloud Services:

AWS Lambda, Firebase Cloud Functions

AI & Automation:

Computer Vision: OpenCV, TensorFlow

NLP: spaCy, BERT-based text matching

IoT & RFID: RFID Tags & Readers: Arduino, Raspberry Pi

Connectivity: LoRaWAN, Bluetooth, WiFi

Technology Stack Overview

- Edge Layer
  - RFID Readers: Capture data from RFID tags.
  - IoT Sensors: Collect environmental data (e.g., temperature, motion).
  - Edge Gateways: Preprocess and transmit data to the cloud.
- Cloud Layer:
  - Cloud Storage: Store raw and processed data (e.g., AWS S3, Azure Blob Storage).
  - AI/ML Engine: Train and deploy machine learning models (e.g., TensorFlow, PyTorch).
  - Data Analytics: Generate insights and visualizations (e.g., Tableau, Power BI).
- Application Layer:
  - User Interface: Web or mobile apps for end-users (e.g., React, Angular).
  - APIs: Integrate with third-party systems (e.g., RESTful APIs).
  - Notifications: Send real-time alerts (e.g., Push Notifications).
- Security & Management:
  - Authentication: Ensure secure access (e.g., OAuth).
  - Encryption: Protect data in transit and at rest (e.g., SSL/TLS).
  - Device Management: Manage RFID readers and sensors (e.g., AWS IoT Core).

Advantages, Limitations, Scope & Other Key Aspects

1.Advantages:

Real-time tracking and visibility.

Predictive analytics for proactive decisions.

Scalable and cost-effective.

2.Limitations:

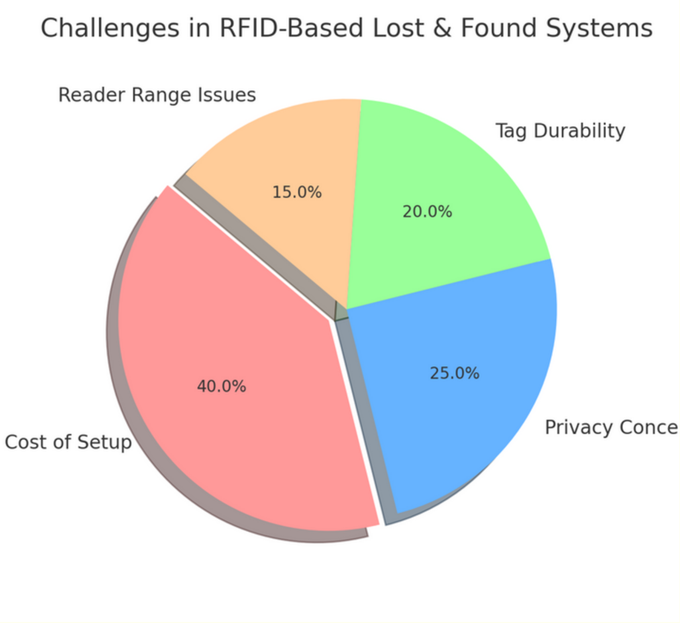
- High initial setup cost.
- Data privacy and security concerns.
- Dependence on stable internet connectivity.

3.Scope:

- Applicable across industries (retail, logistics, healthcare).
- Use cases: Inventory management, asset tracking, predictive maintenance.
- Future enhancements: IoT integration, advanced AI models.

4.Other Key Aspects:

- Sustainability: Reduces waste and improves resource utilization.
- Compliance: Meets industry standards (e.g., GDPR, HIPAA).
- User-friendly interfaces and real-time notifications.



Market Analysis

1. The lost and found market is expected to grow by 7% annually.
2. The global lost and found market is worth over $7 billion.
3. North America is the largest market for lost and found services.
4. The Asia-Pacific region is expected to have the highest growth rate for lost and found services.
5. The transportation sector is the largest consumer of lost and found services.

References & Resources

IoT-Based Warehouse Management System Leveraging RFID and Cloud Platform Technologies
This paper introduces an IoT-based warehouse management system that utilizes RFID technology and the Firebase Cloud platform to enhance inventory management.
A Cloud Computing Architecture Framework for Scalable RFID
This study proposes a cloud computing architecture designed to enhance the scalability of RFID systems, addressing challenges like data collisions and processing limitations.
RFID IoT Architecture for Smart Inventory Management: Security Integration
Focusing on security, this paper discusses the integration of RFID-based IoT systems with features like authentication protocols and geofencing for improved inventory management.
ieeexplore.ieee.org
Integrated AI and RFID Tracking Systems: State-of-the-Art Review
This review explores the combination of RFID and AI technologies in tracking systems, highlighting advancements and applications in various fields.
ieeexplore.ieee.org
Examining The Interdependence of AI and RFID
This article discusses how AI and RFID technologies complement each other, with AI enhancing RFID data analysis and RFID providing valuable data for AI systems.

LOSTING WEBSITE

RESEARCH AND PUBLICATION