Depot Darpan

A case study on an innovative depot monitoring system powering transparency, efficiency, and food security at scale.

CSM Technologies
Food Corporation of India

The Depot Monitoring System utilizes IoT, AI, and mobile tools to track, audit, and enhance warehouse performance in real-time ensuring safer storage and stronger food security.

Introduction

Hunger remains one of the world's most pressing challenges. In 2023, more than **735 million people globally** experienced hunger - an alarming rise from **613 million in 2019**, driven by the cascading impacts of climate change, conflict, and economic volatility (FAO, 2023). Despite being the **world's largest producer of pulses** and the **second-largest producer of rice and wheat**, India faces a paradox of surplus production and widespread food insecurity. Ranked **111th** out of 125 countries in the Global Hunger Index 2023, nearly **16.6%** of the population remains undernourished, underscoring critical inefficiencies in the food supply chain.

A major contributor to this disconnect lies in the storage and distribution ecosystem. India reportedly loses over **1.5 million tonnes** of food grains annually due to inadequate storage infrastructure and mishandling (FSSAI, 2022). These losses not only erode economic value but also weaken the nation's ability to uphold its **Sustainable Development Goal (SDG) 2 - Zero Hunger and SDG 12.3 - Reducing food loss and waste by 2030**.

Recognizing the urgent need for transformation, the Department of Food and Public Distribution (DFPD), Government of India, in collaboration with **CSM Tech**, introduced **Depot Darpan** - a next-generation **Depot Monitoring System**. Designed to modernize India's warehousing framework, Depot Darpan leverages technologies such as I**oT, AI, geo-fencing,** and **real-time analytics** to bring visibility, accountability, and data-driven intelligence to depot operations.

It is redefining the warehousing landscape-enabling digital self-assessments, remote inspections, standardized ratings, and informed policy interventions - while reinforcing India's national food security architecture and global sustainability commitments.

Challenges

- **Aging and Poorly Maintained Infrastructure:** Most depots are outdated and lack modern storage solutions like silos or climate control, leading to frequent spoilage and grain losses.
- **Manual and Paper-Based Record-Keeping:** Manual inventory processes increase the risk of errors, fraud, and delays, reducing overall operational efficiency and accountability.
- **Inadequate Real-Time Monitoring:** Lack of digital tools prevents live visibility into stock, infrastructure, and staff activity, limiting proactive oversight.
- **Poor Quality Control and Compliance Mechanisms:** No standardized systems exist for hygiene and pest control, making quality checks inconsistent and largely dependent on irregular manual inspections.
- **Delayed Escalation and Grievance Redressal:** Without automated alerts, issues like stock damage or non-compliance often go unreported, worsening losses and delays.
- **Lack of Skilled Manpower and Training:** Staff are often untrained in digital tools and modern warehouse practices, hindering effective implementation of reforms.
- **Limited Transparency and Auditability:** Absence of centralized dashboards and MIS makes it hard to track depot-wise performance or identify operational gaps.
- **Inefficient Stock Movement and Logistics:** Poor planning, lack of integrated systems, and non-adherence to First-in-first-out (FIFO) contribute to delays, spoilage, and logistical inefficiencies.

Solution

The Food Corporation of India (FCI) plays a critical role in safeguarding the nation's food security through the **procurement, storage, and distribution** of food grains across a vast network of depots. With over 80 crore beneficiaries relying on its operations, FCI's mandate requires not just scale, but also efficiency, transparency, and accountability at every level of the supply chain.

Despite this crucial role, FCI's storage infrastructure has faced persistent challenges—aging facilities, manual records, poor visibility into operations, and inconsistent compliance mechanisms. These issues have contributed to grain losses, operational inefficiencies, and difficulties in enforcing uniform standards across depots nationwide.

In response, FCI has launched the **Depot Darpan** Application, a transformative digital initiative aimed at modernizing and standardizing depot operations. This **online platform and mobile application** empowers depot officials to s**ystematically evaluate, self-assess, and improve** their infrastructure, processes, and service quality.

In doing so, the **Depot Darpan Application** reinforces FCI's broader mission to s**trengthen food security** and ensure e**quitable access to essential food resources** across India. It stands as a key milestone in India's journey toward **digitally empowered, resilient, and transparent public distribution systems.**

Key Features:

REAL-TIME MONITORING

Track depot operations, infrastructure, and finances live across all locations.

GEO-TAGGED INPUT SUBMISSION

Depot managers submit verified, location-based data for automated performance scoring.

STAR RATING SYSTEM

Rate depots on infrastructure and efficiency using a transparent scoring model.

100% VALIDATION PROTOCOL

Ensure credibility with supervisor checks and randomized third-party audits.

IOT-ENABLED ENVIRONMENTAL SENSORS

Monitor temperature, humidity, gas levels, and unauthorized access in real-time.

ADVANCED AI TOOLS

Use AI for bag counts, vehicle tracking, and face-based access control.

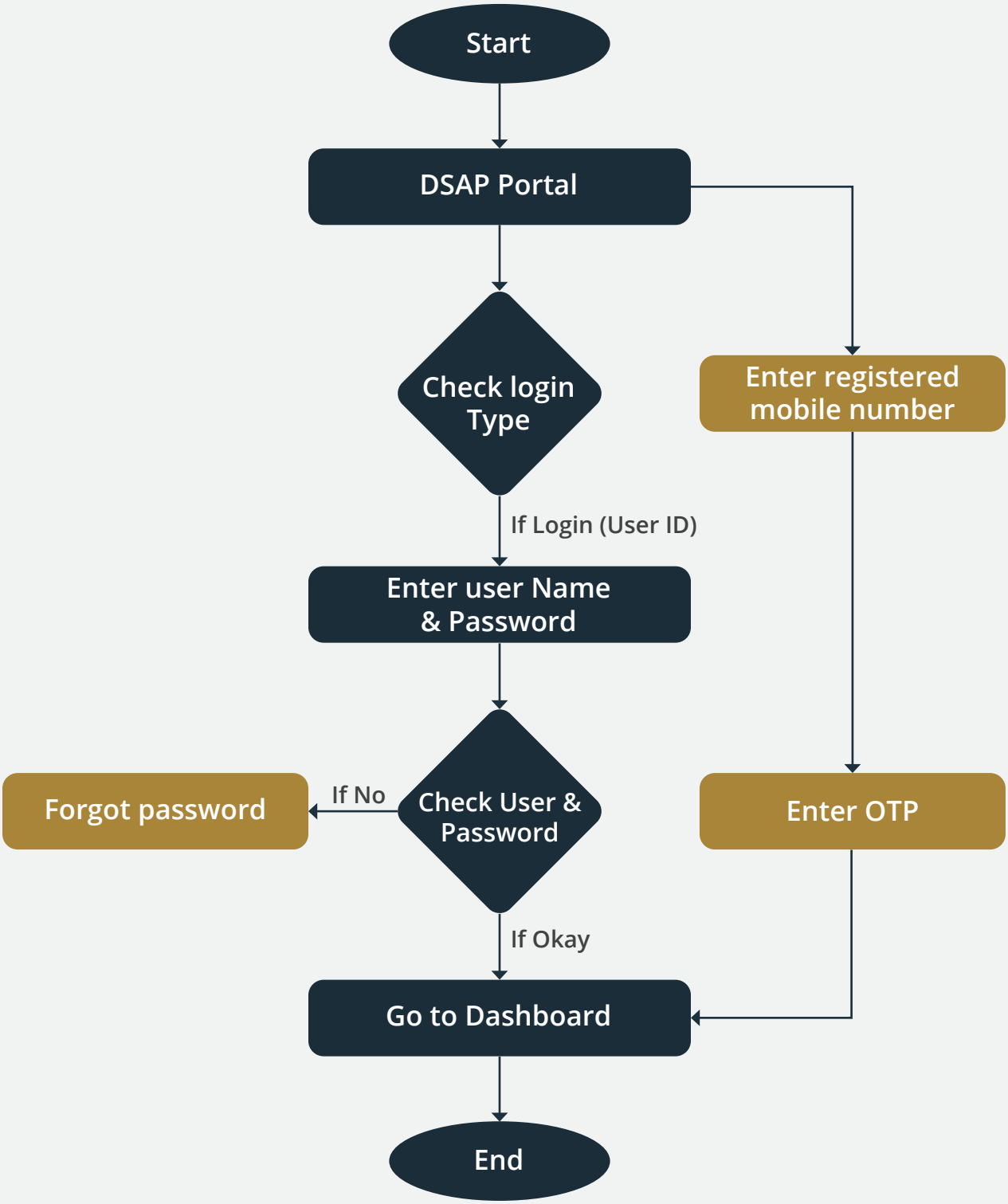
MOBILE APPLICATION FOR OFFICIALS

Geo-fenced mobile app enables offline depot monitoring and real-time assessments.

AUTOMATED DASHBOARDS & REPORTS

Generate real-time reports and dashboards for depot, regional, and zonal reviews.

Process Flow



Technology Stack & Innovations Powering Depot Darpan

Depot Darpan is built on a robust and scalable technology architecture that enables real-time monitoring, data accuracy, and operational transparency across thousands of food storage depots in India. The system integrates the following technological components:

Web & Mobile Application

- Cross-platform access via responsive web and Android mobile app for depot managers, supervisory officers, and ministry officials.
- Offline-first mobile capabilities ensure data collection in low-connectivity zones with later sync.

IoT & Sensor Integration

- **Ambient Sensors:** Measure temperature and humidity to maintain optimal grain storage conditions.
- CO_2 & Phosphine Gas Sensors: Detect pest infestation and fumigation effectiveness.
- Fire & Smoke Sensors: Enable early detection and prevention of fire hazards.
- Shutter Sensors: Monitor unauthorized gate access and ensure proper fumigation protocols.

AI-Powered Modules

- **Automated Bag Counting:** AI-based visual recognition helps verify inventory accuracy.
- **FRS (Face Recognition System):** Access control for secure and verified staff entry.
- **ANPR (Automatic Number Plate Recognition):** Tracks vehicle entry and exit for improved logistics traceability.

Geo-Fencing & GPS Tagging

- Enables location-verified inspections and assessments.
- Ensures depot-level activities are conducted on-site and flagged if offsite.

Smart Monitoring & Dashboards

- Real-time dashboards for ministry and supervisory users to track depot ratings, compliance, and performance across parameters.
- Rule-based automated alerts and escalations for non-compliance or deteriorating conditions.

Analytics & Reporting Engine

- Automated reports, trend analysis, and depot-wise performance heatmaps for evidence-based decision-making.
- Support for monthly and quarterly reviews using validated and timestamped data.

Data Security & Hosting

- Hosted on secure government cloud infrastructure (e.g., NIC Cloud or MeitY-approved cloud service).
- Role-based access, data encryption, and audit trails for integrity and accountability.

Benefits

- **Reduced Grain Losses:** Better monitoring prevents spoilage, leakage, and theft.
- **Near Real-Time Monitoring:** Faster identification and resolution of depot-level issues.
- **Data-Driven Governance:** Actionable insights across 1,000+ depots using smart dashboards.
- **Nationwide Standardization:** Brings uniform review, audit, and compliance structure across all zones.
- **Depot Rating System:** Star-based performance rating promotes healthy competition and transparency.
- **End-to-End Digitization:** From assessment to action tracking, fully digital and auditable workflow.

Impact

- **2,278+** depots across India brought under centralized digital monitoring.
- **100%** digital self-assessments conducted via web and mobile platforms.
- Real-time geo-fenced reviews carried out at over **90%** of depots, ensuring on-site authenticity.
- Over **12,000** assessments submitted, reviewed, and escalated through the platform.
- Automated alerts and escalations enabled swift compliance actions in **80%+** of flagged cases.
- Reduced reporting and compliance time from weeks to **real-time** dashboards.
- Integrated with Oracle BI, CCTV feeds, and SMS/email notifications for **seamless governance**.

Conclusion

The successful implementation of this system by CSM Tech, in collaboration with the Department of Food and Public Distribution and the FCI, showcases how a contextually tailored, tech-enabled governance model can safeguard public resources while reinforcing policy goals, such as Zero Hunger and reduced food loss, under the SDGs.

Beyond its impact on food security, the Smart Depot Monitoring System holds vast replication potential. State governments managing PDS and warehousing can adopt it to improve compliance, transparency, and efficiency. Moreover, its scalable architecture makes it applicable across sectors—from agriculture and pharma to mining, infrastructure, disaster logistics, and even defense supply chains. As India strengthens its digital public infrastructure, Depot Darpan stands as a powerful example of how innovation, when effectively deployed, can drive systemic change and ensure that every grain counts—literally and strategically.

CSM Technologies

is a pioneering GovTech organization that harnesses the power of existing and emerging technologies to provide solutions with a tangible impact on the efficiency of governance and quality of citizens' lives.

CSM Technologies is a pioneering Tech Services organization that harnesses the power of existing and emerging technologies to provide solutions with tangible impact on efficiency of governance and quality of citizens' lives.

CSM Technologies (HQ)
E/56, Infocity, Chandrasekharpur
Bhubaneswar, Odisha - 751024
Tel: +91-674-6635 903
Email: info@csm.tech
Website: www.csm.tech

CSM Technologies
903, 9th Floor, Bhikaji Bhawan,
Bhikaji Cama Place,
New Delhi - 110066
Tel: +91-9314772527
Email: delhi@csm.tech

Breaking Thought Barriers

IT Consultancy | Business Solutions | Outsourcing

Additional Locations

CSM Technologies Inc.
15310 Amberly Drive Suite,
60 Tampa FL, 33647,
USA

+1 (509) 408-2507
unitedstates@csm.tech

CSM Tech Corp.
200 Bay St,
North Tower Suite 1200,
Greater Toronto Area,
M5J 2J2, Canada

+1 (647) 267-3819
canada@csm.tech

CSM Tech Limited
3rd Floor, Office Suite No.2,
Western Heights, Karuna Road,
Nairobi, Kenya

+254-713512751
kenya@csm.tech

India
Bhubaneswar | Delhi NCR | Raipur | Mumbai | Patna | Ranchi

Overseas
Kenya | Rwanda | Ethiopia | Dubai | USA | Canada

csm.tech/linkedIn
csm.tech/facebook
csm.tech/twitter
csm.tech/Instagram
csm.tech/youtube