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INVENTORY MANAGEMENT SYSTEM — CASE STUDY

Category Catalog | Product Lists | Stock In and Out Logs | Comments and Attachments | Technical Information

Industry: HVAC Manufacturing | Project Type: Internal Inventory System | Stack: React, Node.js, PostgreSQL

Case Study

FarSight Pvt. Ltd.

Custom Inventory Management System for a Pakistani HVAC Manufacturer

Project Type: Internal Web Application | Industry: HVAC Manufacturing | Location: Pakistan

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01 PROJECT OVERVIEW

FarSight Pvt. Ltd. is a Pakistani manufacturer founded in 2010 by Faryal Shah, operating as one of Pakistan's leading producers of HVAC vibration isolators, shock absorbers, and air filtration systems. The company manufactures and supplies a wide product range including open spring isolators, seismic spring isolators, housed spring isolators, U-channel spring isolators, neoprene and rubber mounts, spring and rubber hangers, neoprene pads, and a comprehensive line of HVAC air filters spanning HEPA, ULPA, bag and pocket filters, aluminium mesh, pre-filters, and V-bank configurations. FarSight serves large-scale industrial clients across Pakistan, supplying equipment to HVAC installations in commercial buildings, hospitals, industrial plants, and government infrastructure projects.

Managing a product catalogue of this breadth, across two distinct product families with multiple model variants in each, had created a serious internal operations challenge. The company commissioned us to build a custom inventory management system that could give the FarSight team real-time visibility into stock levels across every product and category, a complete audit trail of every stock movement, and the ability to attach technical documentation and operational notes directly to the products they describe. The result is a purpose-built internal web application that replaced disconnected spreadsheets and manual tracking with a structured, searchable, and fully auditable inventory platform.

02 THE PROBLEM

FarSight's inventory challenge was a product of the company's growth. What had started as a manageable product line tracked in spreadsheets had expanded into a multi-category catalogue spanning dozens of model variants across two major product families, each with distinct technical specifications, separate vendor relationships, different cost structures, and varying demand patterns tied to seasonal HVAC project cycles across Pakistan.

No Single Source of Inventory Truth

- Stock levels for vibration isolators and air filters were tracked in separate spreadsheets maintained by different team members, with no central system reconciling the two. Discrepancies between what the spreadsheet showed and what was physically on the shelf were discovered only during manual stock counts, which happened infrequently
- Different team members quoting prices and availability to clients would sometimes work from different versions of the same spreadsheet, resulting in quotes that did not reflect current stock positions or accurate per-unit costs
- New stock arrivals from vendors were logged manually in a register and then transferred to the spreadsheet, a two-step process that introduced delays and transcription errors. Stock-outs on high-demand models like the Open Spring Isolator (Model FS) and HEPA filter ranges were sometimes discovered only when an order was being prepared for dispatch

No Stock Movement Audit Trail

- The existing system had no way to answer when a specific quantity of a specific product had entered or left the warehouse. There was no date-stamped log of stock-in and stock-out events, no record of which team member had processed each movement, and no way to reconstruct the history of a product's stock level at any prior point in time
- Without a movement log, calculating the true cost of goods associated with any stock change was done manually and inconsistently. The total cost impact of a stock-out event could not be derived from the system without manual calculation against the per-unit cost recorded elsewhere
- Vendor accountability was difficult to maintain without documentary evidence of delivery quantities and dates. Disputes over delivered quantities had no system record to reference

No Attached Technical Documentation

- FarSight's products have technical specifications critical to correct installation and client communication: load ratings, deflection ranges, material specifications, temperature tolerances, and compliance certifications for HEPA and ULPA filter ranges. These documents existed as PDF files on individual computers and were shared by email, making it impossible to guarantee that a team member quoting a client had access to the current revision of a product's specification sheet
- Comments and operational notes about specific products existed only in email threads and verbal communication, with no structured way to attach them to the relevant product record

No Category-Level Cost Visibility

- Management had no way to see the total inventory value held in any given product category without manually summing values from multiple spreadsheet rows. Questions about the total stock value of all HEPA filter variants, or the combined inventory cost across all spring isolator models, required significant manual effort and were therefore asked rarely
- The absence of category-level financial visibility made it harder to make informed purchasing decisions about which product lines needed restocking and at what scale

03 THE SOLUTION WE ARCHITECTED

We built FarSight's inventory management system as a custom internal web application, accessible to all authorised team members from any device with a browser, requiring no software installation. The system is structured across three interlocking layers: the Category Catalog at the top level, the Product List within each category, and the Product Detail Page where all stock movement, documentation, and communication activity takes place. Every layer was designed specifically around FarSight's product structure and the operational workflows of the people who would use it daily.

04 FEATURE BREAKDOWN

4.1 Category Catalog

The Category Catalog is the entry point to the system and the management view that gives FarSight's leadership an instant snapshot of the entire warehouse organised by product family. Each category is represented as a card on the catalog page, containing the following information at a glance:

Category Catalog — What Each Card Shows

- Category image: a representative product photograph for visual identification, making it instantly clear which product family the card represents
- Category name: clearly labelled, for example Vibration Isolators, Spring Isolators, Neoprene Mounts, HEPA Filters, Bag and Pocket Filters, Pre-Filters
- Number of product types: how many distinct product models exist within this category, giving an immediate sense of the range depth and complexity of each family
- Total stock cost for the category: the live sum of all units in stock across every product in the category multiplied by their respective per-unit costs, expressed in Pakistani Rupees (PKR). This is the most important number on the card for procurement planning and financial reporting

The Category Catalog page therefore functions as a financial and operational dashboard for the entire warehouse at a single glance. A manager opening the system can immediately see which categories hold the most inventory value, which categories have the fewest product variants, and which categories need to be opened for detailed review. The catalog automatically updates

every category's total cost figure in real time as stock-in and stock-out events are recorded within the products inside that category. There is no manual refresh required.

#	Category Name	Product Type Examples	Fields Tracked	Total Cost Display
1	**Vibration Isolators**	Open Spring (FS), Seismic (FLS), Housed (FSY-Z), U-Channel (FSU), Custom	Image, name, types, cost	**Live auto-sum in PKR**
2	**Neoprene and Rubber**	Rubber Mounts (DD), Neoprene Pads (NP), Rubber Hangers (FS-HN)	Image, name, types, cost	**Live auto-sum in PKR**
3	**Spring Hangers**	Spring Hangers (FS-HS), Heavy Duty variants	Image, name, types, cost	**Live auto-sum in PKR**
4	**HEPA and ULPA Filters**	Mini Pleat HEPA, V-Bank HEPA, Deep Pleat HEPA, High Temp HEPA, Mini Pleat ULPA	Image, name, types, cost	**Live auto-sum in PKR**
5	**Bag and Pocket Filters**	F6, F7, F8, F9 efficiency class variants	Image, name, types, cost	**Live auto-sum in PKR**
6	**Pre-Filters**	G1, G2, G3, G4 efficiency class variants	Image, name, types, cost	**Live auto-sum in PKR**
7	**Aluminium Mesh Filters**	Standard frame, Heavy duty frame	Image, name, types, cost	**Live auto-sum in PKR**
8	**Custom and Specialty**	Client-specific configurations and bespoke model variants	Image, name, types, cost	**Live auto-sum in PKR**

4.2 Product List — Inside Each Category

Clicking into any category card opens the Product List for that category: a structured table of every individual product model within that product family. This is where the operational detail lives, giving warehouse staff and procurement managers a complete picture of each model's current stock position without needing to open individual records.

Each row in the product list represents a single product model and displays the following fields side by side:

Product List — Fields Displayed Per Product Row

- Product image: a clear product photograph for visual identification, critical in a warehouse environment where model variants can look similar at a glance
- Model name: the full product model name as used in client documentation and quotations, for example Model FS-3, Model FLS-2, H11 HEPA Mini Pleat 24x24
- Model type: the sub-classification within the category, for example Open Spring, Seismic, Housed for isolators; or HEPA H11, HEPA H12, ULPA U15 for filters
- Quantity in stock: the current on-hand quantity calculated live from all stock-in events minus all stock-out events ever recorded for this product. This number is always accurate to the last recorded movement
- Vendor name: the supplier from whom this product is sourced, supporting procurement decisions and vendor performance monitoring
- Per unit cost: the current cost per single unit in Pakistani Rupees (PKR), set in the product record and updated by administrators when vendor pricing changes

- Total cost: the product's per-unit cost multiplied by the current quantity in stock, updating automatically whenever a stock movement is recorded for this product

The product list is sortable by any column, allowing the team to quickly identify the highest-value stock lines, the lowest-quantity products approaching stock-out, or all products from a specific vendor. A search bar at the top of the list filters by model name or model type in real time as the user types. The total cost column across all rows is summed into the category total that appears on the Category Catalog card, creating a direct link between product-level data and the summary view.

4.3 Product Detail Page

The Product Detail Page is the operational heart of the system. It is where every action related to a specific product takes place, and it contains four distinct sections that work together: the stock movement log, the comments panel, the attachments panel, and the technical information section. Clicking any product from the Product List opens this page.

Stock In and Stock Out Log

The stock log is the core audit trail of the system. Every movement of stock for this product, whether units arriving from a vendor or units leaving the warehouse for a client delivery or internal use, is recorded as a discrete, immutable event in the log. Each log entry contains the following fields:

Stock Movement Log — Fields Recorded Per Entry

- Date: the exact date on which the stock movement occurred, entered by the team member processing the movement at the time of recording
- Movement type: clearly labelled as Stock In (goods received into warehouse) or Stock Out (goods dispatched, consumed internally, or written off)
- Quantity: the number of units moved in this transaction. Stock In entries increase the running total; Stock Out entries decrease it
- Cost impact: the financial value of this movement, calculated automatically as quantity multiplied by the product's current per-unit cost and displayed in PKR. This gives an immediate financial figure to every warehouse event without any manual calculation required
- Running balance: after each entry the log displays the updated quantity on hand following that movement, creating a clear timestamped timeline of how stock levels have changed
- Logged by: the name of the team member who recorded this entry, creating clear accountability for every stock movement in the system

The log is displayed in reverse chronological order with the most recent movement at the top. The team can scroll back through the full history of movements for any product back to the day it was first entered in the system. For products that have been in the catalogue for multiple seasons, this provides a complete operational record that would have been impossible to reconstruct under the previous spreadsheet approach.

Each log entry has action buttons visible to authorised users: Edit to correct data entry errors, and Delete restricted to administrators. All edits and deletions are captured in the system audit

log with a timestamp, the original value, and the corrected value, meaning the log cannot be silently altered. Any change to a historical entry is itself a permanent record.

STEP 1	**Stock In — How It Works** A shipment of spring isolators arrives from the vendor. The warehouse team member opens the product page, clicks Add Movement, selects Stock In, enters today's date and the quantity received, and optionally attaches the vendor delivery note as a PDF. The system automatically calculates the cost impact (quantity x per-unit cost), updates the running balance, and immediately cascades the new total upward to the product list and category catalog.
STEP 2	**Stock Out — How It Works** A client order is being dispatched. The team member opens the product page, selects Stock Out, enters the date and quantity dispatched. The system deducts from the running balance, records the cost of goods leaving the warehouse, and updates all views in real time. An attachment of the dispatch order or delivery challan can be added directly to this movement entry.
STEP 3	**Discrepancy Correction** A physical stock count reveals a discrepancy between the system total and the physical shelf count. Rather than overwriting historical data, a corrective entry is made as a Stock In or Stock Out with a comment explaining the reason for the adjustment. This creates a transparent correction record that preserves the integrity of the historical log while bringing the system total in line with physical reality.

Comments

Below the stock movement log sits the comments section, which functions as a persistent, product-specific communication thread for the entire team. Any authorised team member can add a comment to any product at any time, creating a permanent operational record attached directly to the product it describes.

- Comments are timestamped and attributed to the team member who wrote them, creating a clear record of who communicated what and when
- Any team member can edit or delete their own comment; administrators can edit or delete any comment. All edits are logged with a timestamp and the original text is preserved in the audit record
- This section captures vendor quality observations: if a specific batch of neoprene pads from a particular supplier showed higher rejection rates, that note lives permanently on the product page and is visible to anyone who opens the record in the future, not just in someone's email
- Client-specific configuration details are recorded here: if a Model FSY-Z housed spring isolator was customised for a client's specific load rating, the technical detail of that modification lives in the comment thread on that product page rather than being lost in email

- Installation issues, reorder reminders, and procurement notes all accumulate in this thread over time, turning each product page into a living knowledge base for that product's operational history

Attachments

Each product record has an attachment panel where any relevant file can be uploaded and stored directly against the product. This replaces the previous practice of sharing technical documents by email or keeping them on individual computers with no central, current, accessible copy.

- Supported file types include PDF, JPG, PNG, Excel, and Word documents, covering the full range of documents a FarSight product record may require: technical specification sheets, compliance and test certificates, vendor delivery notes, client drawings and specifications, installation guides, and quality inspection reports
- Each attachment is displayed with its filename, upload date, and the name of the team member who uploaded it. Any authorised user can download any attachment from any device at any time
- Multiple attachments can be associated with a single product, and new files can be added at any time without replacing existing ones. All attachment versions are retained
- For FarSight's HEPA and ULPA filter range, which require certification documentation for large-scale hospital and commercial HVAC projects, having the EN 1822 compliance certificate attached directly to the product record eliminates the workflow of searching email for the correct document version when a client's project engineer requests confirmation of the filter's certification status
- Vendor delivery notes attached to specific stock-in movements provide an auditable link between the quantity recorded in the log and the physical documentation that accompanied the delivery

Technical Information

The technical information section of the Product Detail Page stores the structured technical specifications for the product in a dedicated rich-text field, separate from the comments thread and separate from the stock log. This is where load ratings, deflection ranges, material compositions, operating temperature ranges, filter efficiency classes, airflow capacities, and frame dimensions are recorded in a consistent format for every product in the catalogue.

- The technical information field supports rich text formatting including bullet points, bold text, and simple tables within the specification field, allowing the team to format the technical content consistently with FarSight's client-facing documentation style
- The field is editable by authorised users and every save creates a new version in the version history, so if a product specification is updated when the vendor changes a component material or when a new certification is achieved, the previous version is preserved and the date and author of the update are recorded
- For vibration isolators, the technical information section typically includes: static deflection range in millimetres, load capacity in kilograms per mount, material (steel spring, neoprene, elastomeric), mounting configuration, operating temperature range, applicable standards (ASHRAE, SMACNA), and model-specific installation torque requirements
- For air filters, the information includes: filter efficiency class on the EN 779 or EN 1822 scale (G1 through H14), initial resistance in Pascals at nominal airflow, final resistance,

nominal airflow in cubic metres per hour, frame material and external dimensions in millimetres, media type, and the international certifications held by that filter model

- Having this information on the product page rather than in a separate shared folder means a team member preparing a client quotation or responding to a technical query can open the product, read the specification, and respond accurately in a single workflow without switching applications

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05 TECH STACK

Frontend	React 18 with TypeScript, Tailwind CSS — responsive layout optimised for desktop and tablet use in office and warehouse environments
Backend API	Node.js with Express — RESTful API serving all CRUD operations for categories, products, stock events, comments, attachments, and technical information
Database	PostgreSQL — relational schema with referential integrity enforced at database level, linking categories to products to stock events to comments and attachments
ORM	Prisma — type-safe database client with migration management for controlled schema evolution
Stock Engine	Server-side running total derived by summing all stock_events for a product at query time, ensuring displayed stock levels are always computed from the immutable event log rather than a mutable counter field
Cost Calculation	Automatic cost impact calculation on every stock event entry: quantity multiplied by the product's per-unit cost at the time of the movement, stored as a financial record on the event row
Authentication	JWT-based role authentication with two access tiers: Standard User (view, add stock events, add comments, upload attachments, edit own entries) and Administrator (full CRUD including product and category management, user administration, audit log access)
File Storage	AWS S3 for all attachment storage with pre-signed URL download links, keeping binary files out of the database
Audit Logging	All edit and delete operations on stock events, comments, and technical information fields are written to a dedicated audit_log table capturing user ID, timestamp, action type, and before-and-after values
Search and Sort	Real-time product search within category pages using PostgreSQL trigram indexing on model name and model type fields; all product list columns are client-side sortable
Hosting	Vercel for React frontend, Railway for Node.js backend, Supabase for managed PostgreSQL with connection pooling
Currency	All cost values displayed and stored in Pakistani Rupees (PKR)

Localisation	Date formatting consistent with Pakistani business conventions (DD/MM/YYYY)

06 DATA ARCHITECTURE

The system's database schema was designed to enforce data integrity at the database level and to make the stock log the single authoritative source for all stock quantity and cost calculations. The schema hierarchy flows from categories down to products down to individual stock events, with comments, attachments, and technical information hanging off the product level.

Table	Key Fields	Role in the System
categories	id, name, image_url, created_at	One row per product family. Drives the category catalog cards. Total cost is computed from child product events
products	id, category_id, model_name, model_type, vendor_name, unit_cost_pkr, image_url	One row per product model. Foreign key to categories. Per-unit cost stored here and used in cost_impact calculations on stock events
stock_events	id, product_id, event_type, quantity, cost_impact_pkr, event_date, created_by_id	Immutable log. Every stock-in and stock-out is one row. Quantity in stock is derived by SUM(quantity WHERE event_type=IN) MINUS SUM(quantity WHERE event_type=OUT)
comments	id, product_id, body, created_by_id, created_at, updated_at	Threaded comments per product. All edits tracked; deleted records soft-deleted to preserve audit trail
attachments	id, product_id, stock_event_id (nullable), filename, s3_key, size_bytes, uploaded_by_id, uploaded_at	File metadata in database; binary in S3. Can be attached to a product or to a specific stock event
technical_info	id, product_id, content_rich_text, version_number, updated_by_id, updated_at	One current record per product plus version history rows. Allows specification rollback if needed
audit_log	id, table_name, record_id, action, old_value_json, new_value_json, user_id, timestamp	Captures every edit and delete across all tables. Append-only; no records in this table can be deleted
users	id, name, email, password_hash, role (standard or admin), created_at, last_login	User accounts with role-based access control

The stock_events table is deliberately immutable by design. Rather than storing a single quantity counter that is updated in place on each movement, the system stores every movement as a permanent event and derives the current stock level by computing the sum at query time. This means the current quantity displayed in the system can never drift from what the event history supports, because it is always computed from that history. It also means that a complete audit trail is a structural property of the data model rather than an additional feature layered on top.

07 USER ROLES AND PERMISSIONS

Action	Standard User	Administrator
View all categories and product lists	Yes	Yes
Open any product detail page	Yes	Yes
Add a stock-in or stock-out movement	Yes	Yes
Edit own stock event (within 24 hrs)	Yes	Yes
Add comments to any product	Yes	Yes
Edit or delete own comments	Yes	Yes
Upload attachments to any product	Yes	Yes
View all attachments and download files	Yes	Yes
View technical information	Yes	Yes
Edit technical information	Yes	Yes
Delete any stock event	No	Yes
Edit any user's comment	No	Yes
Add or edit product records	No	Yes
Add or edit category records	No	Yes
Adjust per-unit cost on a product	No	Yes
View the audit log	No	Yes
Manage user accounts and roles	No	Yes
Delete attachments	No	Yes

08 THE END PRODUCT

The FarSight inventory management system replaced a fragmented, error-prone spreadsheet operation with a single, authoritative, always-current record of every product in the warehouse. From the moment a new shipment of spring isolators or HEPA filters arrives from a vendor to the moment the last unit from that shipment leaves for a client project, every step of that product's journey through the warehouse is recorded, timestamped, attributed to the responsible team member, and permanently accessible by anyone with a login.

The Category Catalog gave management something they had not had before: a financial overview of the entire warehouse in the time it takes to load a web page. The total inventory value across all categories, the value held within any specific product family such as all HEPA filter variants, and the number of product models in any category are all visible without a single manual calculation or spreadsheet lookup. For a growing Pakistani manufacturing business that

had been managing this complexity in disconnected files, the shift from that environment to a single live view is the difference between operating in the dark and operating with clear sight.

The Product Detail Page turned what had been an unstructured daily activity into a structured and financially accountable process. Every stock movement now has a date, a quantity, a cost impact in PKR, and a team member's name attached to it permanently. Questions about what was received, when it arrived, how much it cost, and who processed the entry are now answered by opening the log, not by making a phone call or searching an email thread.

The comments and attachment system eliminated the information silo problem that had developed as the team grew. Technical specification sheets, EN 1822 compliance certificates for HEPA filters, vendor delivery chits, and client-specific configuration notes now live on the product page they describe. Any team member preparing a quotation, responding to a technical query, or processing a delivery can find every relevant document and every relevant piece of operational knowledge in one place, on any device, without asking a colleague.

The immutable event log design means that the system's data has a property that a spreadsheet can never have: it is inherently auditable. The current stock level of any product is not a number that someone typed into a cell; it is the mathematical result of every recorded movement since the product was first entered in the system. That distinction, between a number stored and a number derived, is the foundation of the trust that the FarSight team now places in the system as their operational record for the warehouse.