Smart Multi-Branch Stationery Shop ERP with Demand Forecasting and Stock Reorder Planning

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***Abstract*—A wide range of problems related to inventory coordination, sales monitoring, vendor management, and stock replenishment arise in the case of running multiple branch stationery companies. The use of manual bookkeeping, spreadsheets, and separate billing systems by many enterprises results in lack of stocks, excesses, late replenishment decisions, and unsynchronized branch work. In order to eliminate the mentioned problems, the purpose of this paper is to propose an innovative Smart Multi-Branch Stationery Shop ERP with Demand Forecasting and Stock Reorder Planning. The offered ERP includes the following modules: branch management, role-based user control, products and categories administration, vendors administration, billing, inventory management, stock transfers, and reporting tools. Besides, there is implemented a forecast and reorder feature, based on the analysis of the recent sales trends to estimate the future demand and place appropriate orders. The development process used Next.js, React, TypeScript, Prisma ORM, and SQLite technologies. The developed ERP has multiple types of users with different roles: super administrator, branch manager, biller, and inventory worker. With help of the forecasting and reorder function, the risk of out-of-stock situations can be minimized, since this will make inventory more available, as well as inter-branch transfers will help to avoid redundant purchases.**

***Index Terms*—ERP, multi-branch inventory, stationery shop, demand forecasting, reorder planning, stock transfer, billing system, retail management.**

I. Introduction

The ERP system is commonly used by enterprises to link all the core processes of the company under one software application. In the retail industry, the ERP system allows integration of stock management, purchasing, sales, supply chain management, accounting, and reporting processes. Many small and medium-sized stationery companies continue to utilize separate billing applications, spreadsheets, manual systems, or branch-specific software. These disparate methods pose a significant challenge once the company grows beyond one branch.

Generally, the stationery shop deals with many high-volume products such as exercise books, ballpoint pens, pencils, rubbers, markers, files, charts, printing paper, glue, and teaching aids. The volume of demand for such products varies depending on factors like re-opening season of schools, exam period, office requirements, events within the vicinity, and large institutional orders. Without any central coordination, the managers at the branch level do not have accurate information about the stock position within the company. For example, one branch may experience a stock-out problem, but the other branch might have surplus stocks of that product.

Another problem facing such operations is that of poor reorder plans. Many stores rely on gut feeling rather than the trend of sales history when it comes to restocking their shelves. Such an approach results in situations where there is either insufficient inventory or excess stocks. Overstuffed stocks block capital and storage space while insufficient stocking limits sales potential. Such problems become worse for companies with branches spread out in different locations.

In order to overcome the above mentioned challenges, a Smart Multi-Branch Stationery Shop ERP System is recommended in this paper. This software solution will combine the important functions of the main business and will include a prediction system based on past sales data to predict future demand. This ERP system will provide features such as branch-wise inventory management, common suppliers and product master file management, role-based control, report generation, billing capabilities, stock transfer management, and more.

The application is developed using advanced front-end and back-end frameworks to build an entire application. The system offers not only operational benefits, but also helps in planning for the future. The key aspect of the system under development is not only its digitalization of stationery shop operations but also making those operations efficient by providing intelligent inventory management assistance.

II. Problem Statement

Stationery companies which operate in various branches face certain difficulties because of lack of intelligent software for support. These difficulties can be described as:

- absence of information about stocks at each branch in real time,
- lack of integration of invoices and stock reports,
- inability to decide when reordering should be done,
- poor organization of transferring of stocks between branches,
- manual calculation of demands,
- lack of decision-making tools,
- poor role-based security.

In such a situation, a company experiences shortage of stock, overstocking, inconsistency of data about products, poor quality of services, and poor control over the business. So, there is a need for centralized and intelligent multi-branch ERP system.

III. Objectives

The main goals of the suggested system are:

1) To develop and deploy a centralized ERP for a chain store selling stationery.
2) To handle users, branches, suppliers, categories, products, and inventories in an integrated way.
3) To facilitate billing and record keeping for each branch.
4) To keep track of the current stock available at each branch in real-time.
5) To facilitate the transfer of stocks between different branches.
6) To predict the immediate future demand for products using their sales history.
7) TTo suggest the optimal number of reorders based on the current inventory and prediction.

IV. Scope of the Work

Functional areas that will be covered by the system include:

- secure login and role-based user access,
- creating branches and managing them,
- managing categories and products,
- managing suppliers and purchases,
- managing inventory including stock movements,
- generating bills and sales invoices,
- managing transfers between branches,
- managing dashboards and reports,
- forecasting demands and reorders.

This system is designed keeping in mind the requirements of stationery shop chains. However, this system architecture can also be used in other retail stores, such as bookstores, educational materials shops, office supplies shops, and others.

V. Literature Need and Research Gap

Several small-scale retail shops have billing software that concentrates solely on entering sales data each day. These billing software may help generate invoices and even have a database of all products, but they do not offer centralized management for branches, forecasting services, and inventory balancing to facilitate the movement of goods. On the other hand, there are many large-scale commercial ERP packages with numerous functionalities, which can be too costly and complicated to use.

This paper highlights the primary issue regarding research and implementation in the absence of a small-scale, web-based, industry-specific ERP solution, which incorporates the following three functionalities:

1) stationery inventory management at multiple branches,
2) role-based workflow management at retail stores,
3) reordering based on sales history.

Academic literature on inventory management models typically includes a single store-based system or general retail management system without any provisions for branch-wise transfer and forecasting. Similarly, most retail shop management solutions available in practice lack support for branch-wise monitoring or reordering suggestions. Thus, the proposed study intends to bridge this gap by designing an ERP model specific to the stationery retail industry.

VI. Need and Motivation

Rationale behind the development of this system includes creating a practical, cost-effective, and scalable ERP system which is custom designed to cater to stationery store companies with many branches. Having a common platform makes it easy for shopkeepers to track different branches from one point while individual branches carry out their activities on a daily basis. Forecasting and reorder functionality adds an element of insight which is missing in traditional billing applications. Another important academic rationale for the development of this application is that this software incorporates database modeling, full-stack development, business process modeling, role-based authorization, and predictive algorithm all within one integrated product. Thus, this application is equally useful from both business and engineering perspectives.

VII. Proposed System

The recommended system is an ERP application. It is meant to be used on a central control level as well as the branch level. The different modules are presented in Fig. 1.

The following roles can use the system:

- **Super Admin:** oversees all branches, users, products, and reports for the entire company.
- **Branch Manager:** oversees stock, sales, and reordering at the branch level.
- **Billing Staff:** handles invoices and sales entries.
- **Inventory Staff:** handles stock movements and adjustments.

A. Core Functional Modules

This ERP includes the following modules.

1) Authentication and Role Management: This module authenticates the credentials of users and ensures that access is provided on the basis of roles and branches. It increases security and provides control. The dashboard can be accessed by authenticated users, and the roles have limited access.

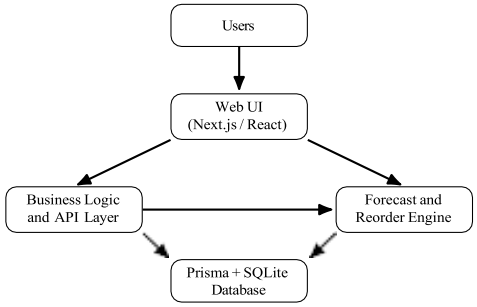

Fig. 1. High-level architecture of the proposed system

2) Branch Management: This module holds data about the id of the branch, its location, and other operationally relevant information. This helps to enable central control and filtering at the level of branch in all operations.

3) Product and Category Management: Products are categorized in terms of writing materials, paper products, office supply, and art materials. This module holds critical information about each product such as their SKU number, selling price, minimum and maximum stock, and other supplier details.

4) Supplier Management: This module holds vendor information and procurement tracking functionality. Improves supplier coordination.

5) Inventory Management: This module holds the information regarding stock quantity, minimum stock, and safe stock level of each product. This serves as the heart of the business management process.

6) Billing and Sales: This module allows the record to be maintained on sales entry, item selection, billing, and sale record storage. Helps to keep track of a reliable sales record.

7) Stock Transfer: Whenever one branch has extra stock while another one suffers from a shortage, a stock tran sfer is carried out and recorded.

8) Dashboard and Reports: This module gives information on profits made, low stock products, recent sales, performance of branches, and demand forecasting.

VIII. Use Case View

Fig. 2 shows the functional interaction between main users and the system.

IX. System Design

The suggested system is built using a modular approach, whereby there is communication between the user interface and the application logic, and the latter communicates with the database and forecasting module.

A. Technology Stack

The technology stack is listed in Table I below.

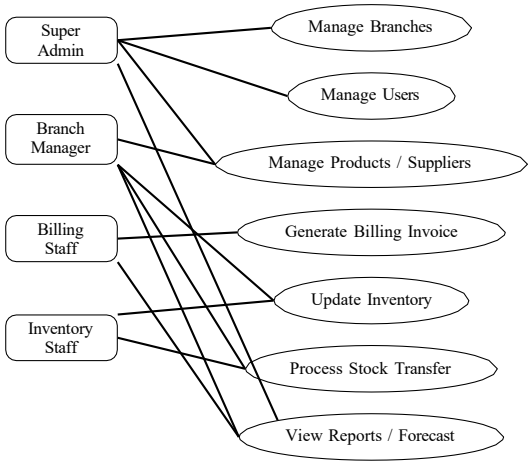

Fig. 2. Use case view of the ERP system

TABLE I
Technology Stack

Layer	Technology
Frontend	Next.js, React, TypeScript
Styling	Modern component-based UI
Backend	Server-side routes and application logic
ORM	Prisma
Database	SQLite
Validation	Zod / form validation
Security	Password hashing, token-based session support
Charts	Recharts

B. Database Design

The database schema has been developed to accommodate both transactions and future forecasting. Entities within the database include:

- User
- Branch
- Category
- Product
- Supplier
- Inventory
- Inventory Log
- Sale and Sale Item
- Purchase Order and Purchase Item
- Stock Transfer and Transfer Item
- Demand Forecast

Critical relationships include:

- one branch has many users and many inventory records,
- one category has many products,
- one supplier has many products and purchase order,
- one product has many inventories,
- one sale has many sale items,
- one transfer has many transfer items.

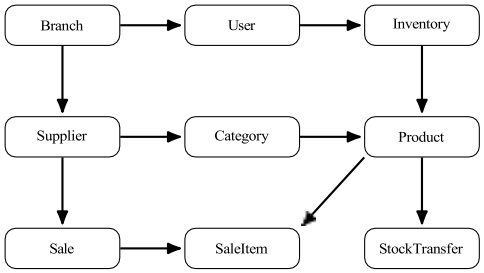

Fig. 3. Simplified ER view of the proposed database

C. Database Rationale

There has to be a relational structure for the reason that inventory-related processes require data which should be traceable and consistently available. For instance, sales transactions will have to be associated with the respective parent invoices; inventory will have to be associated with a branch and an item; and reordering will have to be based on recent movement history. Relational schema simplifies reporting since transactional data can be associated accordingly.

D. Operational Workflow

The operational workflow of the system can be outlined as follows:

1) User login to the system.
2) Loading of the dashboard based on roles.
3) Management of sales, inventory, products, and suppliers through appropriate modules.
4) Constant updating of item activity from sales information.
5) Reading the latest sales information by the forecasting module.
6) Generating of suggestions to reorder items.
7) Recommending an inter-branch transfer, if applicable, prior to procurement.
8) Generation of reports for business operations.

X. Module-Wise Functional Description

A. Authentication Module

Authentication is used to authenticate the registered users allowing access only after successful login. Users' passwords are stored in the form of hashes, and user role information is stored on every successful authentication attempt. This ensures that operational data like billing details, branch inventory, suppliers, and report generation are protected.

B. Inventory Control Module

This module contains information about the present quantity, minimum inventory, safety inventory, and adjustment made in inventory per item in all branches. Whenever there are any sales, transfer, or manual inventory updates made, they get updated in this module. It would therefore help identify the need for replenishment dynamically.

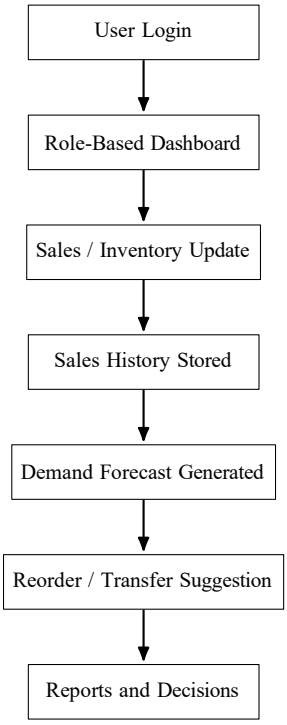

Fig. 4. Overall workflow of the ERP system

C. Billing Module

Billing module supports easy entry of transactions. Staff can select items, enter quantities, generate invoice amounts and save transactions. Each transaction will have a parent transaction which makes it possible to track each transaction.

D. Supplier and Procurement Module

Suppliers' information is maintained as master database containing details about the supplier and his contact. Purchase orders can be created for branch, suppliers, and items.

E. Forecasting and Reorder Module

In this module, information on the recent movements of the products is taken into account, and future demand is forecasted. Recommendations regarding replenishment are provided and it is ensured that the stock balance cannot first be achieved by moving it between different branches.

XI. Algorithmic Design

This segment describes the logic involved in forecasting and reordering decisions.

A. Demand Forecasting Method

In order to forecast demand, the technique employs sales information for the recent period. Denoting by Q the total number of units sold for any given item over the past four weeks, the average demand per week is calculated using the formula below:

$$D_{avg} = \frac{Q}{4} \quad (1)$$

as And the forecasted demand for the next week is estimated

$$D_{pred} = \frac{Q}{4} \quad (2)$$

The technique is quite straightforward, and hence makes the decision-making process simple.

B. Reorder Logic

For all products in each branch, the software considers the current inventory level, minimum inventory level, safety inventory, and predicted demand. If the inventory level is not enough to meet the threshold, the reordering quantity will be calculated as follows:

$$R_q = (2 \times D_{pred}) + S_s - C_s \quad (3)$$

where:

- R_q = recommended reorder quantity,
- D_{pred} = predicted demand,
- S_s = safety stock,
- C_s = current stock.

This logic intends to keep adequate inventory levels for about two weeks in advance with some safety buffer.

C. Inter-Branch Transfer Recommendation

In the event of an inventory shortage, rather than proceed with creating a new purchase order each time, the system can see if there is any other branch that has excess inventory of the same goods. In case there is any other branch, the ERP can suggestion a transfer of goods within the organization.

D. Pseudo Algorithm

```
Read recent four-week sales for each product and branch
Compute average weekly demand
Estimate predicted demand
Read current stock, minimum stock, and safety stock
if current stock < minimum stock + safety stock then
    Compute reorder quantity
    Check other branches for surplus stock
    if surplus branch exists then
        Recommend transfer
    else
        Recommend purchase reorder
    end if
else
    Mark stock as healthy
end if
```

E. Benefits of the Forecasting Module

Advantages offered by forecasting and reorder module include the following:

- fewer cases of stock out,
- higher availability of fast moving products,
- data-based purchase planning,
- better coordination between branches,
- avoidance of surplus stock.

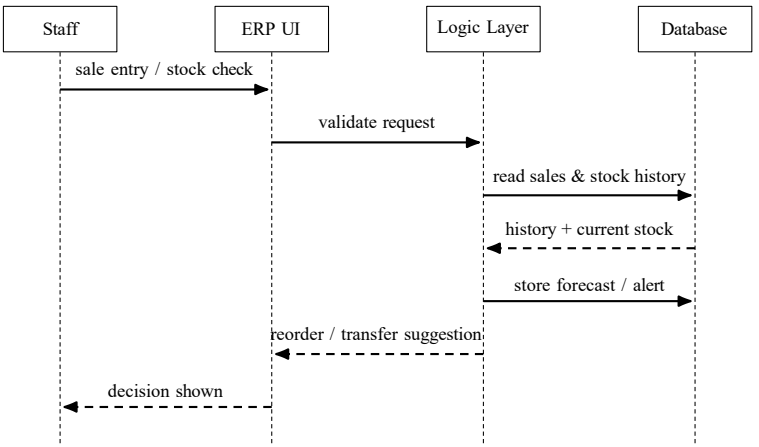

Fig. 5. Sequence of stock evaluation and recommendation

XII. Sequence of Inventory Decision

Fig. 5 presents a simplified sequence diagram of how the system handles stock evaluation and decision generation.

XIII. Implementation Details

The suggested ERP is developed as a complete web application. It utilizes Next.js and React along with TypeScript to de- velop its frontend part. The application makes use of Prisma ORM to interact with the database underneath. Such architec- ture allows for neat and efficient development process. Pages and forms included in the app are user login page, view dashboard form, create new products form, register suppliers form, check inventories form, billing and accounting form, stock transferring form, and reports generating form. Data validation is performed in order to make sure required information is input in a correct and consistent way (e.g., SKU uniqueness, quantity correctness, visibility based on branch). Prisma allows for declarative interaction with the database, including declaring models in the schema and querying them safely via client API's. This makes development easier and error-free at the query level. As the application should serve as an academic minor project and a small-scale retail store ERP, SQLite is enough for current implementation purposes. It could be easily scaled up with migration to PostgreSQL or MySQL.

A. Frontend Considerations

The front end takes care of user interaction, navigation, forms processing, and dashboard display. A role-oriented front end increases usability since each user only gets to see the most appropriate options.

B. Backend Considerations

The back end manages validation, business rules, au- thentication logic, inventory modification, billing compu- tation, and report generation. Maintaining such rules at the back end enhances consistency and security.

TABLE II
SAMPLE TEST CASES

ID	Test Scenario	Expected Result
T1	Valid login	Dashboard opens correctly
T2	Invalid login	Error message shown
T3	Add product with duplicate SKU	Validation prevents save
T4	Create sale invoice	Stock decreases correctly
T5	Low stock item after sale	Reorder alert generated
T6	Surplus in another branch	Transfer suggestion displayed
T7	Unauthorized user action	Access denied
T8	Forecast calculation	Predicted quantity computed correctly

C. Security Considerations

Password hashing ensures security of user passwords. Session/token authentication safeguards against unauthorized access. The role-based model guarantees that no branch user can modify data from other branches. Such measures

XIV. TESTING STRATEGY

Testing is necessary in order to guarantee correctness, reliabil- ity, and usability of the developed ERP. These testing techniques are applied:

A. Unit Testing

Each function, including billing amount calculation, reorder quantity calculation, login verification, and stock update logic is tested individually.

B. Integration Testing

Testing of the interaction of front end forms, back end logics, Prisma queries, and data bases.

C. System Testing

Testing of the complete process such as login, sale recording, billing, forecasting, reordering, and transfer processing together.

D. Validation Checks

The following important validations need to be done:

- unique product SKU checking,
- correct invoice generation,
- proper role-based access,
- valid branch mapping,
- correct stock quantity updates,
- appropriate reorder recommendations.

E. Sample Test Cases

Some sample test cases can be seen from Table II above.

TABLE III
ILLUSTRATIVE FORECAST AND REORDER VALUES

Product	4-Week Sales	Stock	Suggested Reorder
Notebook	48	8	21
Pen Pack	60	10	25
File Folder	24	6	11
Marker Box	32	7	14

XV. EXPERIMENTAL ILLUSTRATION AND DISCUSSION

As far as checking the efficiency of the proposed method, one could think of an example of a sample stationery store with three branches where all branches deal with usual sales of notebooks, pens, files, and other artistic supplies. Based on previous sales data for four weeks, one can predict the next week's demand. Let us consider that during four weeks, one branch has sold 48 notebooks. Then:

$$D_{pred} = \frac{48}{4} = 12$$

If current stock is 8 and safety stock is 5, then:

$$R_q = (2 \times 12) + 5 - 8 = 21$$

In conclusion, therefore, the system suggests that an order should be placed for 21 units, unless it is found that there are excess stocks at any other store. Herein lies the application of the system from historical sales data to a tangible inventory policy. Although simple, the forecast is a systematic way of making a plan, which is better than estimating manually.

A. Illustrative Forecast Table

Table III presents some sample figures for certain stationery products.

B. Result Interpretation

The most significant benefit of this ERP system can be found in three ways:

1) **Operational integration:** billing, inventory, suppliers, and reporting are done at once.
2) **Branch coordination:** inventory transfer among branches is systematically recorded.
3) **Decision support:** inventory planning is based on past transfer data and not on intuition.

The more branches there are, the more valuable it becomes to have a centralized system. Otherwise, decision-making is delayed, manual, and prone to errors.

XVI. PERFORMANCE-ORIENTED OBSERVATIONS

This application was developed for academic and business usage on a small scale, so the priorities are accuracy, reusability, and usability instead of performance scalability. Still, some remarks about performance should be noted:

- local database access using Prisma provides for clean query processing;

- modular approach makes it possible to develop any feature separately without changing the overall design;
- role-dependent navigation accelerates workflow for branch staff;
- simple forecasting minimizes computational complexity.

Thus, the current solution can serve as an adequate prototype for development purposes and smaller projects. If the solution is deployed on a production database and in the cloud, it can work for a larger number of users.

XVII. Practical Applications

The developed system can be applied in the sale of school stationery chains, office supply companies, education wholesaling centers, university campus shops, as well as franchise book and stationery retailing companies. It can even be customized to work in pharmacy outlets, gift stores, and other retail establishments that rely on centralization and branch-wise planning. The forecast technique used in the process, although simple, forms the basis for data-driven activities in all sales processes. In academic facilities, the ERP system can be used in managing laboratory consumables, stationery, and supplies for different departments. In business organizations, it will aid owners to track trends in movement, pinpoint obsolete items, and monitor performance of different branches.

XVIII. Advantages

The main strengths of the system are:

- centralization in handling multiple branches,
- combination of modules related to inventory management, billing, supplier information, and reporting,
- secure access based on role assignment,
- minimal manual involvement,
- easy and efficient forecasting of demand,
- better inventory planning and coordination of transfers.

XIX. Limitations

There are some limitations with regard to the current version of the system:

- forecast is done using simple moving averages only,
- SQLite may not be suitable for extensive use,
- advanced analysis and seasonal forecast are not comprehensively provided,
- barcode scanning and GST compliance have not been considered,
- mobile applications are not supported yet.

XX. Future Enhancements

Improvements could be made to the project in the following directions:

- forecasting models based on machine learning,
- bill payment and inventory update using barcodes or QR codes,
- alerts sent via SMS/email regarding low inventory/purchase details,
- GST-compliant generation of invoices,
- switching to cloud-based relational databases,
- analysis of supplier performance,
- mobile app for branch managers, etc.

XXI. Conclusion

The paper introduced a Smart Multi-Branch Stationery Shop ERP with Demand Forecasting and Stock Reorder Planning. Such a system aims to solve various challenges facing retailing, such as lack of coordination among branches, inadequate visi- bility of inventory, manual reorder processes, and limited reporting support. Using branch management, user roles, suppliers, products, billing, inventory, stock transfer, reporting, and forecast-driven reordering, the system provides a comprehensive solution for stationery companies. The paper shows that an internet-based ERP integrated with some lightweight prediction tools can greatly enhance the efficiency of retail management. The proposed system can be used not only in practice but also implemented for acade- mic research. Future development of the proposed system may include machine learning, barcode handling capabilities, and cloud hosting.

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