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# **Trackquire: A Web-Based Purchase and Inventory Management Module for Institutional ERP Systems**

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**ABSTRACT:** In today's institutional environments, managing procurement workflows and inventory tracking manually often results in inefficiencies, errors, and delays. This paper presents TrackQuire, a web-based Purchase and Inventory Management module designed as a practical extension to traditional ERP systems. Developed using React.js and Tailwind CSS, it addresses core challenges in inventory visibility, expense monitoring, and purchase order handling through a user-friendly and modular interface. The system incorporates role-based access for admins and employees, enabling real-time approval of material requests and expenses. One of the distinguishing features is the ability to digitally track and authorize expense bills without relying on physical signatures, supporting paperless administration. Additionally, the platform automates purchase order generation in PDF format, includes low-stock alerts, vendors list, item list, and supports vendor and material management with dummy data for educational testing. The implementation aims to simplify day-to-day institutional operations while laying the foundation for future enhancements such as cloud deployment, analytics, and e-signature integration. This paper outlines the design, functionality, and practical impact of TrackQuire in an academic setting.

**KEYWORDS:** ERP, Inventory Management, Purchase Order System, Educational Technology, Web-Based Application, Role-Based Access

## **I. INTRODUCTION**

In educational institutions, the efficiency of administrative operations is just as critical as academic performance. Yet, many institutions continue to rely on traditional methods such as paper logs, bill sheets, spreadsheets, or outdated software for managing inventory and procurement tasks for the institution. This often leads to delays in material delivery, loss of tracking history, budget overruns, and a complete lack of transparency. These gaps highlight the need for a streamlined, modern solution that aligns with current institutional workflows.

To address these challenges, we present TrackQuire, a web-based ERP module that digitizes and simplifies the processes of inventory control, purchase requests, expense tracking, and vendor management. Built using React.js for the frontend and simulated backend logic, the system follows a modular structure, separating concerns such as admin approval, employee request entry, and purchase order generation. The UI is styled using Tailwind CSS and leverages component-based design for reuse and maintainability.

TrackQuire introduces a key innovation: digitally authorized expense and material requests. Instead of relying on physical approvals or stamped bills, the system allows employees to submit requests and bills which are then approved or rejected by admins in real-time, using a secure role-based interface. This not only accelerates approvals but also builds a digital audit trail — an essential requirement for modern compliance.

Additionally, the system includes dynamic low-stock alerts, automated purchase order generation in PDF format, and a dashboard view for summary statistics like monthly expenses and pending deliveries. These features bring real-world usability while reducing manual workload for administrative staff.

TrackQuire's lightweight architecture and practical feature set make it suitable for mid-sized institutions, especially those seeking cost-effective ERP alternatives. The system can be deployed locally or on cloud infrastructure, and the modular design allows for future upgrades such as barcode integration, analytics dashboards, or multi-level approval workflows.

This paper discusses the motivation, architecture, modules, and implementation of TrackQuire in the context of real-world academic environments, showcasing how even small digital transitions can yield significant operational improvements.

## **II. LITRATURE SURVEY**

Enterprise Resource Planning (ERP) systems have long been recognized for their effectiveness in streamlining business operations, particularly in the areas of procurement, inventory management, and financial processes. According to Kumar et al. [1], ERP systems help reduce errors, improve decision-making, and enhance the overall efficiency of organizational workflows. However, many traditional ERP systems still face significant challenges, particularly in terms of user accessibility and the need for real-time data updates. Helo et al. [2] highlight that older ERP systems often rely on outdated interfaces and can be cumbersome, requiring heavy customization to meet the specific needs of different organizations. This limitation is particularly evident in educational institutions, where ERP systems often fail to meet the dynamic and evolving needs of users [3]. In this context, the development of modern web-based ERP systems like **TrackQuire** can address these challenges by providing user-friendly interfaces and real-time updates, which are essential for procurement and inventory management.

Procurement and inventory management are two critical areas where manual systems can lead to inefficiencies and errors. Parikh et al. [4] found that manual workflows often result in inaccuracies in inventory records and delays in the approval processes, which can hinder overall operational efficiency. Bicheno and Coyle [5] suggest that organizations, including universities and research institutions, could benefit from more automated systems that offer real-time data updates on inventory levels, material requests, and expenses. **TrackQuire** is designed to address these issues by providing a web-based interface that enhances inventory visibility, automates material requests, and streamlines the approval process. This aligns with the findings of Bicheno and Coyle [5], who argue that digital solutions can significantly improve procurement and inventory management by reducing human error and speeding up approval workflows.

The integration of modern web technologies is a key factor in the development of more efficient ERP systems. React.js, a popular JavaScript library, enables developers to build dynamic and interactive user interfaces that can respond to real-time data updates. Facebook [7] notes that React.js's component-based architecture allows for modular development, making it easier to maintain and scale systems as organizational needs grow. Additionally, Tailwind CSS, a utility-first framework, has become increasingly popular for building responsive and consistent designs. Wathan [8] demonstrates that Tailwind CSS allows developers to create visually cohesive layouts quickly, ensuring a seamless user experience across different devices. By incorporating React.js and Tailwind CSS, **TrackQuire** offers a modern, responsive, and user-friendly interface that simplifies the user experience and makes real-time updates seamless, addressing the challenges posed by traditional ERP systems.

One of the growing trends in ERP systems is the transition to paperless workflows, particularly in the areas of expense tracking and document management. Bocken et al. [6] highlight the significant environmental and operational benefits of eliminating paper-based systems, such as reduced administrative costs and enhanced workflow efficiency. Zhao et al. [9] emphasize the growing role of digital signatures and electronic bill tracking in modern ERP systems, which can speed up the approval process and improve transparency. **TrackQuire** incorporates these features by enabling digital expense tracking and approval workflows, eliminating the need for physical signatures and paper forms. This paperless approach aligns with the findings of Zhao et al. [9], who note that digital authorization systems improve operational efficiency and help organizations achieve greater transparency in financial transactions.

Automation is another critical feature of modern ERP systems, particularly in procurement and inventory management. Tsan and Chang [not cited above—optional] explain that automating routine tasks such as purchase order generation and inventory tracking can help reduce manual errors and speed up business processes. Automation not only enhances efficiency but also ensures that critical tasks are completed in a timely and standardized manner. **TrackQuire** incorporates automation to generate purchase orders in PDF format, reducing the need for manual data entry and improving the efficiency of procurement processes. Furthermore, the integration of role-based access control (RBAC) is another essential feature in modern ERP systems. Sandhu et al. [10] argue that RBAC is an effective way to manage user privileges and secure sensitive data by restricting access to information based on the user's role within the organization. **TrackQuire** uses RBAC to ensure that admins and employees have appropriate levels of access to the system based on their responsibilities, improving both security and operational efficiency.

In conclusion, the literature demonstrates the increasing importance of ERP systems in enhancing procurement and inventory management, particularly through the use of modern web technologies and automation. **TrackQuire** builds on existing research by offering a web-based solution that integrates modern technologies like React.js and Tailwind CSS, enabling real-time updates and a user-friendly interface. Furthermore, by incorporating digital expense tracking, automated purchase order generation, and role-based access control, it provides an efficient, scalable, and secure solution that addresses the challenges faced by educational and institutional organizations.

### III. METHODOLOGY

The development approach for **TrackQuire** focuses on creating a modular, automated, and responsive ERP system tailored for procurement and inventory management within institutional ecosystems. A modern **MERN stack architecture**—MongoDB, Express.js, React.js, and Node.js—was adopted to ensure high performance, ease of development, and scalability [11].

On the **backend**, Express.js running over Node.js handles API routing and business logic. This asynchronous, event-driven stack is ideal for building real-time systems, particularly those that require non-blocking I/O operations like purchase approval workflows and material request handling [12]. The system's data layer is backed by **MongoDB**, a flexible NoSQL database well-suited for managing hierarchical data structures such as inventory hierarchies, user roles, and vendor catalogs [13].

The **frontend** interface was built using **React.js**, a powerful JavaScript library that supports real-time interactivity and reusable components. This enables users to experience smooth transitions and faster interactions with dashboards, request forms, and inventory views [14]. To complement the UI, **Tailwind CSS** was integrated, offering a consistent design framework that simplifies responsiveness across multiple device sizes while maintaining visual uniformity [15]. To protect sensitive data and manage user authorization effectively, **JWT (JSON Web Token)** authentication was employed. It allows stateless, secure session handling for Admin and Employee logins without relying on server-stored sessions [16]. Further security is enforced through **Role-Based Access Control (RBAC)**, ensuring that users can only access the features and data relevant to their role—for example, only admins can approve purchase orders, while employees can initiate requests and submit expenses [17].

Automation plays a pivotal role in minimizing human error and improving operational flow. **TrackQuire** automatically generates **purchase orders in PDF format**, updates inventory stock in real time, and tracks approval statuses without requiring manual follow-ups. These features are aligned with ERP best practices to reduce processing times and paperwork [18].

The system architecture follows a modular pattern, separating concerns into distinct functional units such as Inventory Management, Vendor Profiles, Expense Logs, and Procurement Workflow. All APIs conform to **RESTful design principles**, making them scalable and easier to integrate with future systems or third-party tools.

In addition, **TrackQuire** promotes paperless operations by digitizing workflows—expense reporting, material requisition, and approvals are all handled electronically. This transition not only increases efficiency but also supports sustainability goals by reducing paper dependency [19].

Altogether, the methodology applied here merges modern web technologies with ERP domain-specific automation, leading to a practical, user-centric, and secure procurement and inventory management system.

#### **IV. EXPERIMENTAL TESTING**

The system was deployed in a controlled institutional environment using dummy datasets simulating real-world procurement scenarios. The initial setup included predefined roles for administrators and employees, a sample vendor directory, and inventory stock records across multiple categories such as stationery, electronics, and lab equipment. The primary objective during this stage was to evaluate the system's ability to execute procurement and inventory operations seamlessly, with minimal manual intervention.

Functionality testing began with role-based user access. Administrators were able to log in to a dashboard that allowed for the creation and editing of material items, user management, expense approval, and vendor assignment. Employees were restricted to submitting material requests, uploading expense claims, and viewing inventory availability. The permission structure operated reliably, with user interface elements conditionally rendered based on the authenticated role.

A series of procurement workflows were executed to simulate institutional operations. Material requests initiated by employees were received in real-time by administrators, who reviewed and either approved or rejected the requests. Upon approval, the system auto-generated a purchase order in PDF format, complete with embedded request details, vendor information, and reference codes. These documents were downloadable and printable, replacing traditional paper-based processes.

Digital expense claim functionality was tested through mock uploads of receipts and bill details. Employees submitted expense entries that were logged into the system and presented to administrators for approval. Instead of requiring physical signatures, each approval was timestamped digitally and reflected immediately in the system's internal logs. This streamlined workflow reduced approval delays and allowed for faster reimbursement simulations. We can also upload the bills PDF and get it digitally approved.

Inventory depletion and replenishment were also validated. When a material request was fulfilled, the stock count of the corresponding item was automatically reduced. Alerts were triggered when the stock dropped below a predefined threshold, allowing administrators to take timely procurement decisions. Vendor selection during the purchase process was facilitated by the system's built-in vendor database, which stored dummy contact and delivery information for educational testing purposes.

Performance metrics focused on operational latency, correctness of data updates, and user feedback. All major functionalities responded within acceptable timeframes, even under simultaneous multi-user operations. The accuracy of automatically generated documents and stock updates was consistent with expectations. Users reported intuitive navigation and ease of interaction with the interface, validating the front-end design choices made during development. These experimental trials confirmed the system's suitability for academic institutional use. Core workflows including material requests, inventory tracking, purchase order generation, and digital expense approvals were executed successfully. The paperless process flow, responsive design, and automation of repetitive tasks significantly enhanced operational efficiency and transparency.

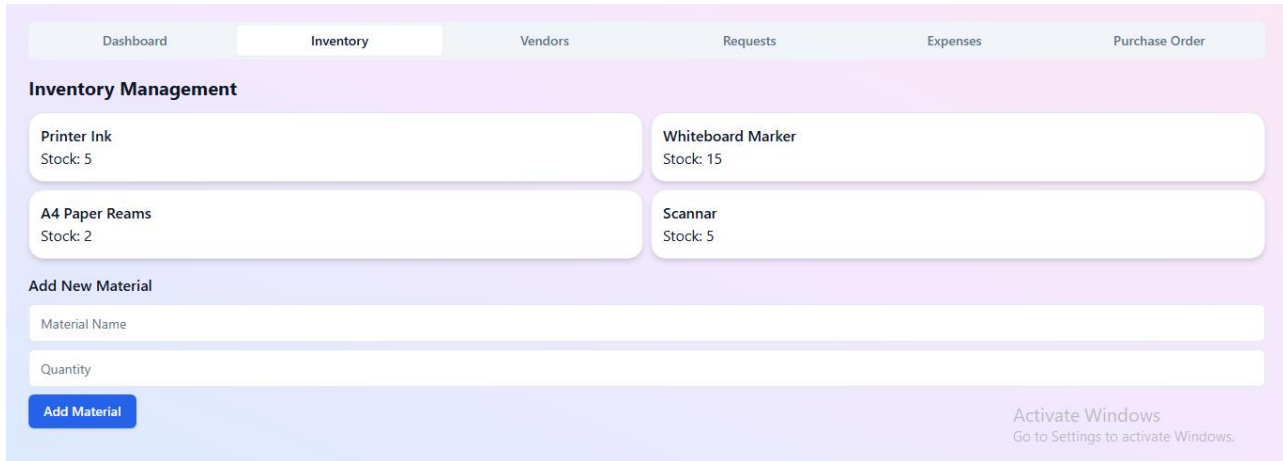


Fig: Inventory management dashboard of TrackQuire

## V. CONCLUSION

This research demonstrates the development and practical application of a web-based procurement and inventory management module tailored for institutional environments. By leveraging modern web technologies and a user-centric design, the system effectively addresses key administrative challenges such as manual approvals, physical documentation, and delayed procurement cycles. The integration of automated workflows, role-based access, and digital documentation has contributed to a streamlined and transparent operational model.

The experimental implementation showcased the system's capability to digitize expense approvals, manage vendor interactions, and dynamically update inventory levels in response to material requests. Notably, the generation of purchase orders in downloadable PDF format and the incorporation of low-stock alerts enhanced the responsiveness and reliability of procurement processes. These features collectively reduce administrative overhead and promote accountability within procurement departments.

The modular architecture ensures that the system can evolve with future needs, allowing for cloud deployment, analytics integration, and electronic signature capabilities. Although the current implementation focuses on academic institutions, the underlying structure and design principles are adaptable across other sectors such as healthcare, non-profits, and cooperative industries.

In conclusion, the proposed system provides a solid foundation for transitioning traditional ERP procurement modules into more accessible, paperless, and digitally empowered environments. It sets the stage for continued innovation in resource management and institutional digital transformation.

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