
WATER PURIFICATION

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DOI: <https://www.doi.org/10.56726/IRJMETS63549>

ABSTRACT

This research presents a comprehensive approach to developing an e-commerce web application for water filters, using React.js for the frontend and Node.js for the backend. The application supports customer registration, login, product browsing, and purchasing functionalities. When a new customer signs up, their information is securely handled by the backend, where the Node.js server sends data to a MySQL database. A cookie-based tracking system is utilized to monitor user sessions, enabling customers to view products and make purchases. Purchase data is recorded in a database table, linking each product to the customer's ID. This data linkage allows the application to use Twilio's API for sending scheduled SMS notifications to customers, reminding them of product servicing. This system architecture effectively combines session management, data persistence, and automated messaging for enhanced customer experience. The application's modular design ensures scalability, secure data handling, and the potential for future feature expansion.

Keywords: React.js, Node.js, MySQL, E-Commerce Application, Twilio API, Customer Session Management, Automated SMS Notifications, Data Persistence, Water Filters.

I. INTRODUCTION

This project centers on developing a comprehensive e-commerce web application for purchasing and servicing water filters, combining a React.js frontend with a Node.js and MySQL backend to enhance user experience and operational efficiency. Through a streamlined interface, users navigate between pages—Home, Products, Signup, and Login—with React's component-based structure ensuring responsive and reusable UI components. Node.js handles backend data requests, managing interactions with a MySQL database that securely stores user and product data. Upon signing up, user sessions are tracked via cookies for personalized experiences and seamless navigation. The integration of Twilio's SMS API further improves customer service, sending timely notifications about product servicing, which enhances engagement and support. Overall, this project leverages modern technologies to create a scalable and user-focused e-commerce platform.

II. EASE OF USE

The project prioritizes ease of use by leveraging React.js for a responsive, intuitive, and user-friendly frontend, ensuring customers can navigate pages like Home, Products, Signup, and Login seamlessly. React's component-based architecture allows for consistent design elements across pages, making the interface simple and predictable for users. On the backend, Node.js with MySQL ensures smooth data handling, while session tracking with cookies creates a personalized experience that lets users pick up right where they left off. Additionally, Twilio SMS notifications provide convenient updates, keeping users informed about product servicing without any extra effort. Altogether, the project's design and technology choices make it highly accessible, offering a streamlined experience from signup to product servicing.

III. LITERATURE SURVEY

The recent literature on web development emphasizes the need for robust, user-friendly, and scalable systems, especially in sectors like e-commerce, where seamless user experience and efficient data management are critical. **React.js's** component-based architecture enables developers to build interactive user interfaces with efficient state management, providing a smoother and more responsive user experience. Studies have noted that SPAs built with React reduce server load by minimizing page reloads, which leads to faster performance and lower latency. React's use of the **Virtual DOM** also enhances UI rendering speeds, a significant advantage in high-traffic applications where response time is crucial.

On the server side, **Node.js** has become a prominent choice for building scalable, event-driven applications. Research shows that Node.js's non-blocking, asynchronous architecture enables it to handle concurrent requests effectively, making it suitable for applications with high user interactions or real-time data processing.

When combined with **MySQL**, a relational database management system known for its reliability and robust performance with structured data, Node.js can efficiently handle complex data queries, transactions, and database relationships that are essential in e-commerce environments.

User tracking and session management through **cookies** is another important aspect, with recent studies focusing on privacy implications and secure session handling. Cookies help in identifying returning users, preserving session states, and providing a personalized experience, which aligns with user expectations for convenience and security. Integrating **Twilio SMS notifications** for updates and service reminders aligns with user engagement strategies found in the literature, where real-time notifications are shown to increase customer satisfaction and loyalty by ensuring timely reminders and feedback loops.

Moreover, the **MERN (MongoDB, Express, React, Node)** and **LAMP (Linux, Apache, MySQL, PHP)** stacks have been evaluated extensively for web applications, with recent literature highlighting the benefits of full JavaScript stacks, like **MERN**. However, for applications requiring structured data storage and efficient SQL querying, MySQL with Node.js is a preferable combination due to its flexibility in handling relational data and support for complex data relationships, making it highly effective for applications like customer purchase tracking.

This project architecture, combining **React.js** for the front-end, **Node.js** for the back-end, **MySQL** for data storage, and **Twilio** for real-time alerts, reflects best practices in modern web development, allowing for a seamless, scalable, and user-centric system. The system design is intended to support real-time user engagement, efficient data management, and enhanced performance, each aspect backed by current research trends in full-stack development.

IV. METHODOLOGY

The methodology for the water filter e-commerce system involves a structured approach across front-end, back-end, and integration stages to create a responsive and user-friendly platform. The front-end is developed using **React.js**, providing a dynamic, single-page application experience where each section—such as Home, Contact, About, Products, Signup, and Login—is built as a modular component. New customers are directed to the Signup page to enter their details, which are then validated and sent to the back-end server for storage. To maintain user sessions, cookies are utilized to store the user's email, ensuring continuity and a personalized experience throughout the app. The back-end server is set up with **Node.js** and **Express**, operating on a separate port for scalability, and it communicates with a **MySQL** database that stores customer information and purchase records in structured tables. The database includes a **Customer Table** to log signups and a **Product Table** that tracks purchases, associating each product with the customer's ID for traceability.

To further personalize the user experience, Twilio's API is integrated to send SMS alerts to customers following their purchases, informing them of product servicing and other relevant details. The integration of cookies allows for accurate tracking of active users and links them to their purchase history, enabling tailored service notifications. Data flows seamlessly between the front and back ends, with user data from signup forms validated and securely stored in the database. During the testing phase, the UI/UX is tested for responsiveness across devices, while back-end functionality is verified to ensure reliable data flow. Performance is optimized for both the Node.js server and

MySQL queries to handle multiple connections efficiently, minimizing load times and maximizing application performance. This approach results in a cohesive and scalable solution, connecting a dynamic front end with a robust back end and ensuring an engaging and supportive user experience through data integrity, real-time notifications, and seamless session management.

V. SIMULATION RESULTS

In the simulation phase of this water filter e-commerce system, the complete functionality of both front-end and back-end components was tested to ensure efficient communication, user tracking, and accurate data flow. The **React.js** front end was simulated in a browser environment to verify responsiveness, navigation flow, and the effectiveness of cookies in maintaining user sessions. Upon successful signup, cookies were created and validated, allowing smooth transitions between pages and retention of user data across sessions.

For backend simulation, **Node.js** was configured to handle incoming requests from the front end on a separate port, verifying asynchronous data handling for multiple concurrent users. **MySQL** database queries were

tested to confirm that customer details and purchase data were correctly stored, retrieved, and associated with customer IDs. Each simulated purchase action updated the **Product Table** with the correct customer ID, creating a reliable log of purchases linked to individual users.

To validate the notification system, simulated purchase events triggered the Twilio SMS API, sending test notifications to confirm that customer alerts were dispatched promptly. The system's efficiency in recognizing user sessions via cookies and associating purchase data with the correct customer ID was also successfully simulated, demonstrating reliable user-specific interactions. Performance metrics showed efficient load handling for multiple users, and database queries performed optimally, confirming that the system could scale effectively under increased load.

Overall, the simulation confirmed that the system could reliably track user actions, manage data storage, and send real-time notifications. This comprehensive testing verified system stability and demonstrated that the developed solution provides a smooth, responsive user experience with accurate session handling, database integrity, and notification functionality.

VI. CONCLUSION

The Water Filters E-Commerce Web App effectively demonstrates the integration of a React.js frontend and a Node.js backend to create a seamless online shopping experience. By allowing customers to easily sign up, log in, and browse products, the application prioritizes user accessibility and engagement. The use of cookies to track user sessions enhances security and personalization, ensuring that customers receive tailored interactions throughout their journey. On the backend, the server efficiently manages customer data and product transactions, leveraging a MySQL database for robust data storage and retrieval. The integration of Twilio for SMS alerts exemplifies a proactive approach to customer service, providing users with timely reminders about product servicing. Overall, this project showcases a modern, full-stack approach to e-commerce development, emphasizing user experience, efficient data management, and effective communication through alerts. The combination of these technologies not only enhances functionality but also lays the groundwork for future enhancements, such as expanding product offerings or integrating additional customer service features.

ACKNOWLEDGEMENT

We would like to express my sincere gratitude to Mrs. Manswini Parlikar for her invaluable support and guidance throughout this research project. Her dedication to helping us, the Polytechnic students in IT, has greatly enriched our learning experience and provided us with the necessary resources to excel in our studies. We also extend thanks to all the faculty members and staff who have contributed to our growth and development. Your encouragement and expertise have been instrumental in shaping our understanding of the subject. Last but not least, we are grateful for the unwavering support from my family, whose love and encouragement have been my foundation during this journey. Thank you all for being a significant part of this endeavor.

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