E-BOOK OF EXTENDED ABSTRACT

THE 14TH INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025

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QR CODE IMPLEMENTATION FOR EFFICIENT TIMBER INVENTORY MANAGEMENT SYSTEM

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ABSTRACT

The timber industry frequently faces some serious issues related to inefficient inventory practices, including inaccurate stock records, excess inventory, and a lack of real-time data. These challenges contribute to resource wastage, financial losses, and disrupted supply chains. In response, this innovation project introduces a QR Code-based Timber Inventory System, a smart solution that integrates Quick Response (QR) codes with real-time monitoring to modernise timber inventory management. Based on three key Sustainable Development Goals (SDG 12 and 13), the system promotes responsible consumption, climate action, and ecosystem preservation. This innovation uses QR codes to incorporate and monitor information related to timber types, origin, quantity, and sustainability credentials. Scanning the codes provides real-time access to updated inventory data through mobile devices or integrated databases. The development of this innovation process follows a design thinking methodology, involving empathy, ideation, prototyping, and testing. This system is expected to have significant improvements in inventory accuracy, processing speed, and waste reduction due to fewer errors in tracking, enhanced decision-making capabilities, and better compliance with forestry regulations. Additionally, this system supports ethical logging by increasing transparency and traceability within the supply chain. Despite limitations such as dependence on device availability, internet connectivity, and potential integration challenges with legacy systems, the system offers a scalable, cost-effective, and eco-friendly alternative to traditional inventory methods. The QR Code Timber Inventory System not only addresses current inefficiencies in the timber industry but also provides a model for digital transformation aligned with global sustainability agendas.

Keywords: timber inventory system, real-time monitoring, inventory management, QR code, Sustainable Development Goal (SDG)

1. INTRODUCTION

The management of timber inventory contributes significantly to the operational productivity, re-sourcing efficiency, and cost effectiveness of the timber industry, which is confronted with multifaceted issues, such as stock resource degradation, environmental regulations, and market uncertainty. Traditional stock systems have always included manual data entry and inefficient tracking solutions that do not allow for the easy, real-time analysis of the information needed to keep a business moving. Such problems not only result in financial losses but also create environmental destruction, for example, in the form of waste and illegal logging. This research seeks to overcome these limitations through the introduction of a novel timber inventory management system that is based on Quick Response (QR) codes. Real-time data capture and traceability that align with the United Nations' Sustainable Development Goals (SDGs), including SDG 12 (responsible consumption and production) and SDG 13 (Climate Action) (Industrialised Building System, 2024).

2. METHODOLOGY

The QR code-based Timber Inventory System design process employed the Design Thinking Framework (Figure 1), encompassing of five stages: empathising with the problem faces by the industry and defining inventory problems through a comprehensive literature review, then, ideating a QR-based

solution, prototyping using software like SketchUp, and testing through simulation involving real-time QR scanning, synchronisation several trials, and analyse the outcome. The prototype incorporated mobile scanning applications linked to the database, simulating inventory operations for accuracy, traceability, and user-friendliness.

Figure 2 Design thinking framework.

3. FINDINGS

The implementation of the QR code system demonstrated significant improvements in inventory accuracy and operational efficiency compared to conventional methods. Automated data capture via QR scanning drastically reduced human errors typically associated with manual data entry. Real-time monitoring enabled dynamic inventory adjustments, effectively preventing problems of overstocking, which ties up capital and storage space, and stockouts, which disrupt production and sales (Malaysia Industrialised Building System (IBS) vs Traditional Construction Method. E3S). The traceability feature provided by unique QR codes for each timber product enhanced supply chain transparency, facilitating compliance with legal standards and sustainability certifications. Simulation outcomes highlighted the system's usability, with mobile interfaces providing intuitive navigation and prompt feedback during scanning tasks. Furthermore, integrating the system with Industrialised Building System (IBS) components demonstrated its potential to support lean construction principles by optimizing inventory flow and reducing material waste. This system directly supports SDG 12 and SDG 13. This integration reflects a strategic advancement in aligning timber inventory management with contemporary sustainable building practices (Inventory Management: Definition, Elements, Types, and Benefits, 2023).

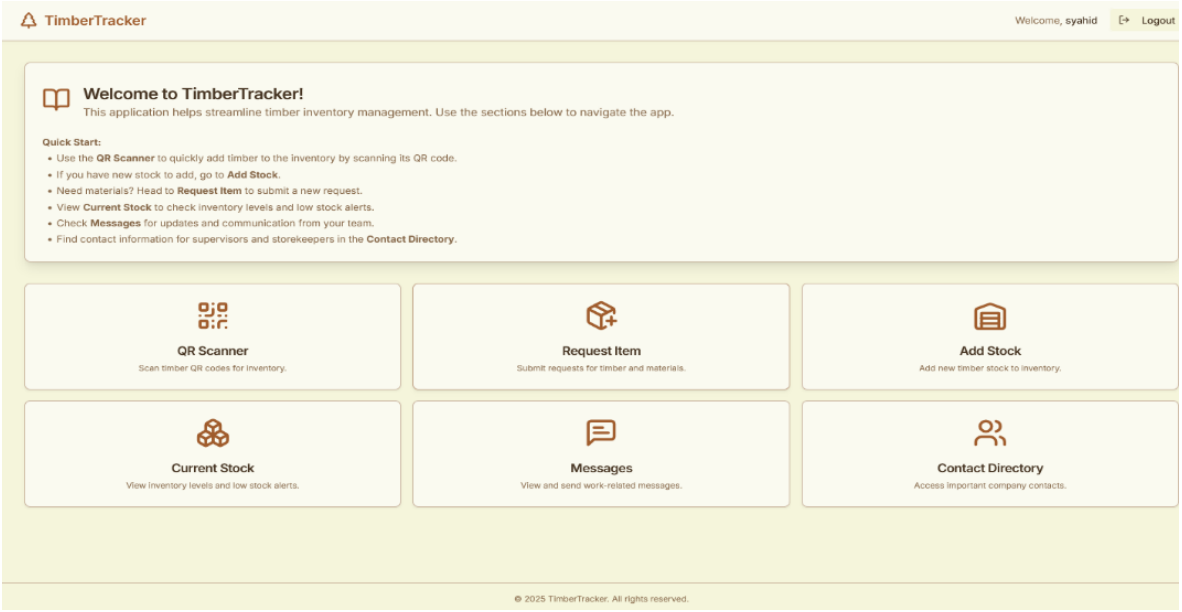

Figure 2 TimberTracker main menu

4. CONCLUSION

The study confirms that QR code technology offers a robust and innovative solution to the pressing challenges faced by the timber inventory management sector. The system's capacity to provide real-time, accurate data transforms traditional inventory processes, leading to enhanced operational efficiency, reduced environmental impact, and greater alignment with global sustainability goals. By automating key inventory tasks and facilitating comprehensive traceability, the QR code-based system empowers timber businesses to improve resource utilisation and strengthen supply chain integrity. Additionally, its user-friendly design and reliance on widely available mobile technology lower barriers to adoption, ensuring scalability across different industry sizes and contexts. This research underscores the significant potential of digital innovation in revolutionising timber inventory practices, promoting sustainable forestry, and supporting the timber sector's transition towards a more responsible and resilient future.

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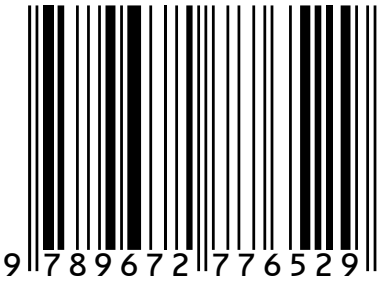

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