A Project Report on

**Raw Material Inventory Management**

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C E R T I F I C A T E

This is to certify that

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has successfully completed the project work entitled *“****Raw Material Inventory Management****”* under my supervision, in the partial fulfilment of *Third Year* *B. Tech - Mechanical Engineering*.

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We look forward to leveraging the knowledge and experience gained from this phase to successfully complete the project.

Yours sincerely,

Om Tapare

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**ABSTRACT**

Effective inventory management plays a crucial role in enhancing operational efficiency and reducing costs. Many companies, however, rely on manual methods for tracking inventory, leading to inaccuracies, inefficiencies, and delays in order processing. This project focuses on the design and implementation of a **barcode-enabled inventory management system** for an organization, aiming to address these issues by automating inventory tracking and control processes.

The proposed system integrates **barcode technology with Microsoft Excel** to streamline stock management, improve data accuracy, and minimize human errors. Through comparative analysis, the benefits of barcoding over traditional manual methods and RFID systems are highlighted, emphasizing its cost-effectiveness, ease of use, and reliability. The system enables real-time inventory updates, automatic reorder alerts, and seamless tracking of goods, leading to improved customer satisfaction and operational efficiency. This report provides insights into the development process, challenges faced, and the positive impact of barcoding on inventory management, offering a practical solution for businesses seeking to enhance their stock management capabilities.

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**Nomenclature**

**1.RM** - Raw Material

**2.ROL**  - Reorder Level

**3.POS**  - Point Of Sale

4.**Quantity In** - The amount of raw material received into the inventory

5**.Quantity Out** - The amount of raw material that has been issued.

**6.Std** - Standard

**7.SS** - Safety Stock

**8.Avg** - Average

**1.INTRODUCTION**

Efficient inventory management is critical for businesses to ensure smooth operations, reduce costs, and improve customer satisfaction. Many organizations still rely on manual methods to track stock levels, which can lead to errors, delays, and miscommunication between departments. With the growing complexity of inventory processes, there is an increasing need for automated systems to streamline operations and minimize human error.

This project focuses on the **development of a barcode-enabled inventory management system** to address the challenges faced by organizations using manual tracking methods. Barcode technology offers a cost-effective solution for real-time data tracking, reducing human error, and automating stock management processes. The system will integrate barcode scanning with **Microsoft Excel**, providing an accessible and familiar platform for small to mid-sized businesses to manage their inventory efficiently.

The objective of this project is to **improve inventory tracking, reduce order processing delays, and enable automatic reorder alerts**. This will eliminate the dependency on manual records, ensuring data accuracy and faster decision-making. Through the comparative analysis of barcode systems and manual processes, this report will demonstrate the advantages of adopting barcode technology to enhance operational efficiency and customer satisfaction.

* 1. **Bar Code**

A **barcode** is a machine-readable representation of data that is encoded using parallel lines (1D barcodes) or patterns (2D barcodes). It was first introduced in the 1970s to improve the speed and accuracy of product identification in retail and logistics industries. Over time, barcodes have become a widely adopted tool for **inventory management, supply chain operations, and tracking systems** across various sectors.

* + 1. **How Barcodes Work**

A **barcode scanner** reads the encoded data by shining light onto the barcode and measuring the reflection.

The scanner translates the reflected light into electrical signals, which are processed by software to retrieve relevant product or inventory data.

Barcodes can store information such as **product ID, serial number, batch number, or manufacturing date**, making it easier to track inventory throughout its lifecycle.

* + 1. **Types of Barcodes**

**1D Barcodes**: These are linear codes (e.g., UPC, Code 39, EAN) commonly used in retail stores and warehouses.

**2D Barcodes**: These include QR codes and Data Matrix codes, capable of holding more data in a smaller space and readable even when partially damaged.

* + 1. **Advantages of Barcode Systems in Inventory Management**

**Error Reduction:** Automates data entry, minimizing human error compared to manual systems.

**Time Efficiency:** Speeds up stock entry and retrieval processes through quick scanning.

**Real-time Data Tracking:** Provides up-to-date information on stock levels, order status, and product availability.

**Cost-effective:** Implementing a barcode system is affordable for small to medium enterprises, compared to technologies like RFID.

**Scalable:** Barcodes can be easily integrated into existing inventory management software, making it ideal for businesses of varying sizes.

* + 1. **Limitations Of Bar Codes**

**Error Reduction:** Automates data entry, minimizing human error compared to manual systems.

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* + 1. **Advantages of Barcodes Over Other Identification Technologies**

Barcodes are an established global standard across industries, with widespread use in retail, logistics, and manufacturing. This ensures that existing systems, such as Microsoft Excel or ERP platforms, already support barcode integration. RFID, though advanced, requires expensive infrastructure (like specialized readers and antennas), which can be cost-prohibitive for small or medium-sized businesses. QR codes, while offering more data storage, are often unnecessary for simple tracking tasks where 1D barcodes suffice. Thus, barcodes provide a simpler, faster, and cost-efficient solution for inventory management without requiring specialized equipment or software modifications.

This makes barcodes ideal for projects like Trimurti Dies and Patterns, where the focus is on improving operational efficiency with minimal disruption to current practices.

* 1. **. Microsoft Excel for Inventory Management**

Microsoft Excel is more than a spreadsheet application; it functions as a powerful tool for **inventory tracking**, **data management**, and **business analytics**. Its combination of versatility, accessibility, and ease of integration makes it an appealing choice for companies looking for a low-cost, reliable solution to manage their inventory.

**1.2.1. Excel as a Data Management Tool**

Excel’s core function is data storage and processing, making it a central hub for inventory-related data. Companies can design spreadsheets to manage the following:

* Stock levels and movements
* Supplier information and purchase orders
* Product pricing and sales history
* Forecasted demand trends

This enables businesses to store large quantities of structured data in one place with ease.

**1.2.2. Real-Time Stock Tracking with Barcode Integration**

One of the key advantages of Excel in this project is its compatibility with barcode systems. Scanners can input real-time product data into Excel sheets, updating stock quantities automatically. This setup reduces the manual workload while minimizing human errors in data entry.

**For example:**

* When an item is sold, the barcode scanner updates the stock count directly in the relevant Excel sheet.
* Alerts can be generated when stock levels fall below reorder points, ensuring timely procurement.

**1.2.3 Inventory Analysis and Reporting Capabilities**

Excel’s data visualization tools, including **pivot tables, charts, and graphs**, allow businesses to analyze trends in inventory turnover, sales, and stock levels.

* **Pivot tables** help in summarizing large datasets efficiently.
* **Conditional formatting** highlights critical data points (e.g., low stock levels).
* Excel’s **forecasting tools** can predict demand, helping businesses maintain optimal stock levels.

These features enable **data-driven decisions**, improving efficiency in procurement and storage management.

**1.2.4 Automation with Macros and VBA**

Excel supports **Visual Basic for Applications (VBA)**, which can be used to automate routine tasks. In this project, macros could automate:

* **Stock updates**: Automatically deducting quantities when products are scanned.
* **Reorder notifications**: Sending alerts when stock reaches a certain threshold.
* **Report generation**: Creating daily or weekly stock reports with a single click.

This degree of automation simplifies workflows, saving time and reducing errors.

**1.2.5 Collaboration and Cloud Accessibility**

Excel files can be stored and shared using **cloud services like OneDrive or SharePoint**. This enables real-time collaboration and ensures that employees from different departments have access to the latest inventory data.

* **Simultaneous editing**: Multiple users can work on the same file without data loss.
* **Remote access**: Employees can view or update the inventory from any location with internet access.

This feature ensures seamless communication between teams, such as between **sales, procurement, and warehouse departments**.

**1.2.6 Scalability and Flexibility**

While initially designed for smaller operations, Excel’s flexibility allows companies to **scale their system** as their business grows.

* **Custom templates** can be adapted over time to handle more data and incorporate new product lines.
* Excel’s data can be **exported to more advanced systems** like ERP software if the business requires a more robust solution in the future.

**1.2.7 Limitations of Excel**

Though powerful, Excel does have some constraints:

* **Manual intervention** is often required for complex operations.
* **Version control issues** can arise with multiple editors working on the same sheet.
* **Security concerns**: Password protection is limited compared to dedicated software.
* **Handling large data sets**: As the business grows, Excel may struggle to efficiently process very large datasets without performance issues.

**1.2.8 Why Excel Fits this Project**

For **Trimurti Dies and Patterns**, Excel offers a **practical balance between functionality and cost-effectiveness**.

* The **barcode system integration** allows for quick and accurate stock updates.
* Excel’s **low cost and accessibility** make it suitable for businesses with limited budgets.
* **Customizable templates and reports** ensure that the system can be tailored to the company's specific needs without external software dependencies.

The use of **Excel for inventory management in this project ensures streamlined workflows**, improved accuracy, and easy monitoring. It also provides a **scalable solution**, offering flexibility to grow with the business over time.

**2. LITERATURE REVIEW**

**2.1. Introduction**

Inventory management systems (IMS) are essential tools for tracking raw materials, ensuring efficient supply chain operations, and maintaining production schedules. These systems enable companies to avoid stockouts, optimize storage, and streamline procurement processes. The integration of **barcode technology** within IMS offers significant potential to improve data accuracy and operational efficiency. This review highlights the relevance of barcode-based systems for RM inventory management, discusses the benefits of using **Excel** for small-scale implementation, compares barcoding with other technologies, and identifies challenges.

**2.2. Significance of In Raw Material Inventory Management Systems**

Companies in manufacturing, including those handling **nuts, bolts, and valves**, require inventory systems to monitor raw materials and prevent production disruptions. Proper RM inventory management helps maintain production flow, anticipate demand, and minimize lead times. According to research, inventory systems are necessary to track **incoming and outgoing goods**, monitor fluctuations in demand, and ensure availability of essential supplies.

A **computerized IMS** enables efficient data handling, improving stock visibility and minimizing errors common in manual processes. As noted in previous studies, integrating barcodes ensures real-time data tracking and reduces human error, which is essential for managing raw materials accurately.

**2.3. Benefits of Barcode Implementation in Inventory Management**

Barcode systems play a critical role in **tracking raw materials**. They simplify data collection, reduce manual errors, and allow **instant updates** on stock levels. Barcodes store essential data, such as part numbers, batch details, and quantity, making it easy for operators to scan and record stock movements efficiently.

* **Real-Time Tracking**: Barcode systems provide **instant updates** on material usage and availability, helping inventory managers track the movement of raw materials in and out of the facility.
* **Error Reduction**: The elimination of manual data entry through scanning minimizes errors in recording stock levels, as noted by Chen et al. (2013).
* **Proactive Stock Management**: Barcode systems can flag low-stock items, ensuring timely reordering to avoid production delays.

The use of barcodes is especially effective for companies with high volumes of **small, standardized parts** (e.g., nuts and bolts). Having **automated tracking** ensures that production lines do not face disruptions due to missing components.

2.4. **Using Microsoft Excel for Inventory Management**

For small and medium-sized enterprises (SMEs), Microsoft Excel offers a flexible and cost-effective solution for managing RM inventory. While large industries may adopt specialized software, Excel provides sufficient tools for organizing and tracking stock, especially when integrated with barcode scanners.

* **Ease of Integration:** Barcode scanners can input data directly into Excel, simplifying stock updates.
* **Customization:** Excel templates can be tailored to the needs of RM management, such as tracking batch numbers or reorder points.
* **Cost-Effective:** Excel eliminates the need for expensive software and can be implemented with minimal training.
* **Analytics and Reporting:** With features like pivot tables and conditional formatting, Excel enables easy tracking of material usage trends and inventory levels.

Using Excel with barcodes will allow us to monitor our RM inventory without the complexity of large-scale software, while still achieving operational visibility.

**2.5. Comparison of Barcode Systems with Other Technologies (RFID, QR Codes)**

Although **RFID** and **QR codes** offer advanced capabilities, barcodes remain the preferred solution for RM inventory management at **Trimurti Dies and Patterns** for several reasons:

* **Cost-Effectiveness**: RFID tags are expensive to implement and require specialized infrastructure, making barcodes more suitable for SMEs.
* **Ease of Implementation**: Barcodes are easier to integrate with existing tools like Excel, whereas QR codes may require more complex scanning systems.
* **Simplicity**: For tracking standardized parts, the information capacity of barcodes is sufficient, eliminating the need for more complex data storage (as with QR codes).

**2.6. Challenges and Limitations of Barcode Systems in RM Management**

Despite their benefits, barcode systems are not without challenges.

1. **Damage to Barcodes:** Labels can get damaged, especially in manufacturing environments with dust, oil, or physical wear, rendering them unreadable.
2. **Manual Scanning Dependency:** Operators must manually scan each item, which can be time-consuming for large inventories.
3. **Complexity in Dynamic Environments:** As noted by Dejean et al. (2012), barcode systems can face challenges in highly dynamic settings with frequent material movements.

To overcome these challenges, businesses may explore hybrid solutions by combining barcodes with IoT sensors or automation technologies to reduce dependency on manual processes.

**2.7. Summary**

The literature emphasizes that effective inventory management systems (IMS) are essential for smooth manufacturing operations by ensuring timely availability of raw materials and preventing stockouts. Implementing barcode technology offers several advantages over manual systems, including real-time tracking, reduced errors, and faster stock monitoring.

Compared to RFID and QR codes, barcodes are more cost-effective, easier to implement, and highly compatible with tools like Microsoft Excel. Excel adds value by allowing customized tracking, automated data entry through scanners, and easy reporting, making it ideal for small to mid-sized industries like Trimurti Dies.

Despite these benefits, some challenges remain, such as manual scanning dependency and label damage risks. Future research points toward integrating IoT and automation for greater efficiency and sustainability.

In conclusion, barcode-enabled IMS, combined with Excel, provides a reliable, accessible solution for raw material management, helping businesses maintain efficiency and continuity in operations.

3.Problem Definition

The current manual raw material (RM) inventory management system at **Trimurti Dies** has proven to be **prone to human errors and operational inefficiencies**. The dependency on **handwritten logs** and **manual stock checks** has resulted in:

* **Frequent stock discrepancies** due to errors in data recording.
* **Delays in material tracking**, leading to disruptions in production schedules.
* **Labor-intensive monitoring** with increased operational costs.

Furthermore, the **lack of real-time tracking** means the company faces **stockouts or overstocking**, which directly impacts the efficiency of production lines. Without automation, the **procurement team struggles to ensure timely material replenishment**, which hinders smooth operations and can result in missed deadlines.

To overcome these challenges, **Trimurti Dies** aims to implement a **barcode-enabled inventory management system** integrated with **Microsoft Excel**. This new system will help automate RM tracking, minimize errors, and streamline the stock management process, **improving efficiency and operational visibility**.

**3.1 Need of the Project**

The **manual RM inventory process** is affecting the smooth flow of operations, resulting in:

* **Production downtime** due to delayed stock verification.
* **Inaccurate stock records** caused by human error.
* **High labor costs** due to repeated manual tasks.
* **Procurement delays**, leading to stockouts or unnecessary excess stock.

An **automated barcode-based system** is essential to address these inefficiencies. This solution will **streamline material tracking**, provide **real-time inventory insights**, and ensure **timely procurement** through automated replenishment alerts, supporting continuous production without interruptions.

**3.2 Problem Statement**

The existing RM inventory system at **Trimurti Dies** relies on manual record-keeping and physical stock checks, resulting in:

* **Inconsistent inventory records** due to human errors.
* **Disruptions in production schedules** caused by delayed stock identification.
* **Inefficient material procurement**, increasing the risk of stockouts.
* **Limited transparency** in inventory status across departments.

The absence of a **real-time tracking mechanism** prevents proactive decision-making for timely stock replenishment, thus negatively impacting productivity and operational efficiency.

**3.3 Objectives**

**The primary objectives of the project are:**

* **Implement a barcode-based inventory management system (IMS) integrated with Microsoft Excel.**
* **Automate material tracking to ensure real-time visibility of RM inventory levels.**
* **Reduce human errors in data entry and record-keeping, improving inventory accuracy.**
* **Facilitate faster replenishment processes with automated alerts to avoid stockouts.**
* **Streamline operations and reduce labor efforts by automating repetitive inventory tasks.**
* **Enhance data accessibility, making stock reports available to the production and procurement teams.**
* **Improve production efficiency by ensuring smooth material flow and avoiding disruptions.**

**3.4 Scope**

* **Applicable to RM inventory management** within Trimurti Dies and similar manufacturing units.
* The system will cover all RM-related activities, including **receipt, storage, and usage tracking**.
* Provides **real-time stock levels** accessible to the production and procurement teams.
* Alerts for **low stock levels** and automates replenishment requests through Excel.
* **Scalable for future needs**, allowing more features like supplier integration if needed.

**3.5 Methodology**

* **Requirement Analysis**: Identify RM inventory issues through discussions with company staff and management.
* **Design**: Develop a barcode-based tracking system using **Microsoft Excel** for easy accessibility and management.
* **Implementation**: Integrate barcode scanners with Excel to automate RM stock updates.
* **Testing & Evaluation**: Conduct tests to ensure **system accuracy** and reliability.
* **Training & Deployment**: Train staff on how to use the barcode-enabled system efficiently.
* **Monitoring & Feedback**: Continuously monitor the system’s performance and gather feedback for future improvements.

**4.Flow Of the Process**

**Step I) Barcode Setup and Application**

* A one-time process where barcodes will be generated and assigned to specific storage shelves or bins based on material type and dimensions (e.g., for steel rods, brass valves, etc.).
* Barcodes will be physically applied to shelves or containers where raw materials (RMs) are stored. Each barcode will correspond to a specific category or type of material.

**Step II) Receiving Raw Material from Suppliers**

* Upon **receiving materials** from suppliers, the barcode on the respective shelf will be **scanned** to update the inventory.
* A command will be executed in the system (via Excel) to **log the new stock**, including **quantity, date, and supplier details**. This ensures real-time updates on material availability.

**Step III) Issuing Raw Materials to Production**

* When raw materials are withdrawn for production, the corresponding **barcode is scanned again**, and an "out" command is issued in the system to deduct the withdrawn quantity from the stock.
* The system will automatically track the **remaining balance** and **notify the inventory manager** if the stock level is nearing the reorder threshold.

**Step IV) Tracking and Monitoring**

* The barcode system will provide **real-time insights into the stock levels**. This eliminates the need for manual stock counting and reduces errors.
* The **inventory management team** can access up-to-date stock reports in Excel for review, planning, and audits.

Step V) **Inventory Audits and Adjustments**

Periodic **physical audits** will be conducted to ensure that the system's data aligns with actual stock. In case of discrepancies (e.g., damaged materials or human errors), **adjustments will be made** in the system by scanning the barcode and updating the new stock status.

**5.Basic Structure for Excel**

**1.Master List**

**This sheet will serve as a comprehensive database of all raw materials (RM) used in the factory. The columns could include:**

* Unique Barcode ID: A specific code assigned to each type of raw material.
* Material Type: The name of the raw material (e.g., aluminium, steel, etc.).
* Dimensions: Physical dimensions of the raw material (length, width, height) (optional).
* Shelf Number: The designated location where the material is stored.
* ROL: Trigger level for reordering.
* Supplier Information: Details of the supplier for each material (optional).

A screen shot of a computer

Description automatically generated

**Fig(1)**

**2.**  **Daily In and Out Sheet**

**This sheet will track the daily movement of materials into and out of inventory. The columns might include:**

* Date: Date of the transaction.
* Unique Barcode ID: To link the material to the Master List.
* Material Type: Name of the material being added or removed.
* In/Out: Indicate whether the material is coming in (received) or going out (used).
* Quantity: Number of units being added or removed.
* Remarks: Any notes related to the transaction (e.g., reason for usage, condition of materials).

A screenshot of a computer screen

Description automatically generated

**Fig(2)**

**3. Daily/Weekly/Monthly Summary Sheet**

**This sheet will provide an overview of inventory levels over specific periods. It can have:**

* Date Range: Specify daily, weekly, or monthly summaries.
* Total Materials Received: Total quantity of materials added during the specified period.
* Total Materials Used: Total quantity of materials removed during the specified period.
* Stock Levels: Current stock at the end of the period for each material type.
* Variance: Difference between the beginning and ending stock levels.

A spreadsheet with numbers and numbers

Description automatically generated

**Fig(3)**

**4.Quick Search Stock Checker**

**This sheet will allow users to quickly find stock information without navigating through the Master List. It can include:**

* **Search Box: A field to input the Unique Barcode ID or Material Type.**
* **Results Area: Display relevant information like dimensions, shelf number, and current stock based on the search input.**

A screenshot of a product summary

Description automatically generated

**Fig(4)**

**5.Reorder Level and Safety Stock Calculating Sheet**

* **Reorder Level (ROL):** The inventory level at which a new order should be placed to replenish stock before it runs out.

**Formula - Avg Daily Demand\*Avg Lead Time + SS**

* **Safety Stock:** The extra inventory kept on hand to prevent stockouts caused by uncertainties in demand and lead time.

**Formula – Z \* Std Deviation \* Sqrt (Avg Lead Time on Monthly Basis)**

A screenshot of a chart

Description automatically generated

**Fig(5)**

**Conclusion**

The implementation of a barcode-enabled inventory management system at Trimurti Dies represents a significant advancement in the efficiency and accuracy of raw material management. The current manual system, which relies heavily on handwritten records and manual checks, has been identified as a source of numerous challenges, including stock inaccuracies, production delays, and increased labor costs. By integrating barcode technology with Microsoft Excel, the proposed system will streamline inventory tracking, enhance real-time visibility, and minimize human errors.

Research indicates that automated systems, like barcode inventory management, can dramatically improve operational efficiency by reducing the time spent on stock verification and providing instant access to inventory data (Chen et al., 2013; Fernández-Caramés et al., 2019). Additionally, the integration of safety stock calculations and reorder levels ensures that the procurement process is proactive, reducing the risk of stockouts and overstocking (Dejean et al., 2012).

Furthermore, the comprehensive methodology outlined in this project, from requirement analysis to deployment and ongoing monitoring, underscores the commitment to continuous improvement and adaptation in inventory practices. As businesses strive for greater efficiency in an increasingly competitive market, the adoption of such innovative solutions will be crucial for sustaining productivity and meeting customer demands.

Overall, the transition to a barcode-based inventory management system at Trimurti Dies not only addresses current inefficiencies but also lays the groundwork for scalable improvements in the future. As industries evolve towards automation and smart technologies, this project positions Trimurti Dies to adapt and thrive in the modern manufacturing landscape.

**References**

* Chen, X., Wang, M., & Zhang, J. (2013). Lean principles in RFID-enabled inventory management: A case study. *Journal of Manufacturing Systems*, 32(2), 305-317.
* Fernández-Caramés, T.M., Fraga-Lamas, P., & Vázquez-Fernández, E. (2019). A survey on the use of UAVs and Blockchain in logistics and supply chain management. *Future Generation Computer Systems*, 94, 700-713.
* Dejean, F., Duflou, J., & Vandaele, N. (2012). Managing uncertainties in the supply chain: A literature review. *International Journal of Production Research*, 50(12), 3343-3365.
* **Higgins, J., & Brooks, J.** (2019). "The Impact of Barcodes on Inventory Management Efficiency." *Journal of Inventory Management*, 10(1), 35-48.
* **Thomas, A., & Griffin, J.** (2020). "Analyzing the Efficiency of Barcode Systems in Inventory Management." *Operations Research Perspectives*, 7(1), 45-67.