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Expiry Date Checking System Using Android and Barcode Scanning

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ABSTRACT: ***As an aid in retail management and inventory control, mobile-based systems are used to facilitate automated product monitoring, a form of smart inventory management and real-time tracking. The development of barcode-based expiry checking systems has increased significantly in recent years. Data processing in such systems uses information generated from product databases to improve inventory handling and reduce manual effort when the monitoring process is digitized. SQLite serves as a suitable platform for managing local databases within the application. It provides an efficient and lightweight solution for handling data storage and retrieval in the long run. It also simplifies the integration of additional functionalities such as barcode scanning and data visualization when dealing with large sets of product information. A summary of the system architecture is presented in this study along with examples of components specifically designed for such an application. In addition, it also discusses the implementation of notification alerts and analytical chart visualization techniques.***
Keywords: Inventory Management, Barcode Scanning, SQLite, Android Application, Data Visualization

I. INTRODUCTION

Inventory management systems have emerged due to the widespread use of mobile applications and digital technologies in retail environments and small businesses [11]. These systems make use of multiple features and functions that help in efficient product monitoring and stock handling. These include barcode scanning, automated data entry, notification alerts, and analytical chart visualization, among other functionalities. As a result of integrating shopkeepers, product databases, and mobile applications, inventory management becomes more accurate and easier to handle. Using mobile-based tools provides several advantages, the most prominent of which are task automation, real-time monitoring, adaptability, accessibility, and reduced manual effort [16]. Smart inventory applications are becoming increasingly popular in the field of information technology (IT), particularly after rapid digital transformation and the need for efficient retail management solutions. Various systems have been developed at different levels, such as barcode-based product tracking, mobile inventory systems, and analytical dashboards, implemented globally to support shopkeepers in managing their stock efficiently [21,22]. Compared to traditional manual methods, these smart systems provide improved accuracy, faster processing, and better decision-making capabilities forusers [6,13,20].However, handling large volumes of product data and ensuring accurate expiry tracking requires a reliable and efficient system infrastructure. The need for continuous monitoring of expiry dates and generating timely alerts can create performance challenges in conventional systems. Moreover, product data and stock levels may change dynamically, requiring a system that can efficiently manage updates without affecting performance. To address these requirements, lightweight database solutions are preferred that can operate efficiently within mobile devices. SQLite database provides an effective solution for managing structured data locally within the application [1, 30]. These goals align with the requirements of modern Android-based systems. Unlike traditional server-based databases, SQLite does not require complex configurations and works efficiently in embedded environments [40].It is important to note that modern mobile applications rely on modular design and integration of various technologies to enhance functionality. Barcode scanning technology enables automatic product identification and reduces manual errors, while chart visualization libraries help users analyze product data effectively through graphical representation [37]. These technologies improve system usability and efficiency. Additionally, notification systems play a crucial role in alerting users about products that are near expiry, helping reduce product wastage and preventing health risks associated with expired goods [24, 39].All functionalities of the system are designed in a way that hides technical complexities from users and provides a seamless experience [45]. Compared to traditional inventory systems, this approach reduces operational cost and eliminates the need for additional infrastructure [28]. The integration of efficient data handling and visualization techniques enables better inventory control and faster decision-making [14]. Furthermore, such systems generate a large amount of product-related data, which can be analyzed to improve inventory strategies and reduce losses. Data analysis techniques can be applied to understand usage patterns and optimize stock management processes [25].

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This research focuses on the design and development of an Android-based Expiry Date Checking System that assists shopkeepers in monitoring product expiry, reducing unnecessary waste, and improving health safety standards. The main objective is to provide an efficient, user-friendly, and cost-effective solution for inventory management. The remainder of this paper is organized as follows. Section 2 describes the system architecture, Section 3 explains the working methodology, Section 4 discusses system features and challenges, and finally, Section 5 concludes the paper.

II. LITERATURE REVIEW

All the analysis in the preceding sections is based on the review of mobile-based inventory management and expiry detection systems. The review is conducted using qualitative analysis, which allows researchers to present concepts in a detailed and structured manner. A literature review examines existing research papers, publications, and technical sources related to a specific problem domain and provides a comprehensive understanding of the research area. Inventory management systems have evolved significantly with the advancement of mobile technologies, where applications are used to manage product data, monitor stock levels, and track expiry dates efficiently. These systems integrate various components such as databases, barcode scanning modules, notification systems, and data visualization tools to provide a complete solution for retail management.

In the context of Android-based applications, the concept of embedded database systems plays a crucial role. SQLite is widely used as a lightweight database that allows efficient data storage and retrieval within mobile applications [36]. It enables developers to manage structured data without requiring a separate server or complex infrastructure. In such systems, data related to products, including name, manufacturing date, expiry date, and barcode information, is stored locally and accessed when required. This approach ensures faster processing and better performance compared to traditional server-based systems. Any component, ranging from barcode scanning modules to notification services and chart visualization tools, can be considered as an independent module that contributes to the overall system functionality.

The design philosophy of modern mobile applications emphasizes modularity and integration of services to enhance system performance and usability [38]. Instead of relying solely on manual data entry and traditional record-keeping methods, automated systems use barcode scanning technology to capture product information quickly and accurately. This reduces human errors and improves efficiency. Additionally, the integration of visualization libraries allows users to analyze product data through charts and graphs, providing better insights into inventory trends and product status. These features enhance decision-making capabilities for users, especially shopkeepers managing multiple products simultaneously.

One of the major challenges in inventory systems is handling large volumes of data and ensuring real-time monitoring of product expiry. The system must be capable of updating product information dynamically and generating alerts without affecting performance. Notification systems play a vital role in informing users about products that are close to expiry, allowing timely action to prevent losses. Efficient system design ensures that all functionalities operate seamlessly without exposing technical complexities to the end user [41]. The system architecture is typically divided into different layers or components, where each module performs a specific function and interacts with others to provide a complete solution.

The primary components of such systems include data storage, data processing, user interface, and alert mechanisms. The database layer manages all product-related information, while the application layer handles business logic and user interactions. Barcode scanning modules facilitate automatic data input, and chart libraries provide graphical representations of stored data. These components work together to create a user-friendly and efficient system. Mobile-based inventory systems are particularly beneficial for small and medium-scale businesses, where cost-effective and easy-to-use solutions are required.

Furthermore, these systems generate a significant amount of data that can be analyzed to improve inventory management strategies. Data analysis techniques help in identifying patterns such as frequently expiring products, stock usage trends, and demand variations. This information can be used to optimize stock levels and reduce wastage. The integration of smart technologies in retail management not only improves efficiency but also contributes to better health and safety standards by preventing the sale or consumption of expired products.

In conclusion, existing research highlights the importance of mobile-based inventory and expiry monitoring systems in modern retail environments. The use of technologies such as SQLite databases, barcode scanning libraries, notification systems, and data visualization tools provides an effective solution for managing product data and reducing wastage. These systems offer advantages such as automation, accuracy, scalability, and ease of use, making them highly suitable for shopkeepers and small business owners.

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III. TECHNOLOGY STACK

The proposed Expiry Date Checking System is developed using a combination of modern mobile application technologies and libraries to ensure efficient performance, usability, and scalability. The system is implemented as an Android application, integrating multiple components for data management, barcode scanning, notification alerts, and data visualization.

1) Android Platform:

The application is developed on the Android platform, which provides a flexible and user-friendly environment for building mobile applications. Android supports a wide range of devices and allows seamless integration of various libraries and tools required for application development.

2) Java Programming Language:

Java is used as the primary programming language for backend development. It provides object-oriented features, platform independence, and robust performance, making it suitable for developing scalable and maintainable mobile applications.

3) SQLite Database:

SQLite is used as the embedded database for storing product-related information such as product name, barcode, manufacturing date, and expiry date. It is lightweight, fast, and does not require a separate server, making it ideal for mobile-based applications.

4) ZXing Library (Barcode Scanning):

The ZXing (Zebra Crossing) library is used for implementing barcode scanning functionality. It enables automatic extraction of product information through barcode scanning, reducing manual data entry and improving accuracy.

5) MPAndroidChart Library:

MPAndroidChart is used for data visualization. It provides various chart types such as bar charts, pie charts, and line graphs, which help users analyze product data and expiry trends effectively.

6) NotificationSystem:

The application uses Android's notification services to alert users when products are nearing their expiry date. This feature helps in timely action, reducing product wastage and preventing health risks.

7) User Interface (UI/UX):

The application includes a simple and intuitive user interface designed for shopkeepers. It ensures ease of use, quick navigation, and efficient interaction with the system.

Overall, the integration of these technologies enables the development of an efficient, reliable, and user-friendly expiry date checking system that supports real-time inventory monitoring and decision-making.

IV. SYSTEM METHODOLOGY

The proposed Expiry Date Checking System follows a systematic approach to manage product information, monitor expiry dates, and provide timely alerts to users. The methodology is designed to ensure automation, accuracy, and ease of use for shopkeepers. The overall working of the system is divided into multiple stages, including data acquisition, data storage, processing, and result visualization.

1) Data Acquisition (Barcode Scanning):

The system begins with capturing product information using barcode scanning technology. The user scans the barcode of a product through the mobile application, and the system automatically retrieves the product details. This reduces manual data entry, minimizes human error, and speeds up the process of adding products to the system.

2) Data Storage (SQLite Database):
Once the product information is captured, it is stored in the SQLite database within the application. The database maintains records such as product name, barcode number, manufacturing date, expiry date, and other relevant details. This ensures efficient data management and quick retrieval whenever required.

3) . Data Processing and Monitoring:
The system continuously processes the stored data to monitor product expiry dates. A background process checks the difference between the current date and the expiry date of each product. Based on predefined conditions, products are categorized as valid, near expiry, or expired.

4) Notification and Alert System:
When a product is close to its expiry date or has already expired, the system generates notifications to alert the user. This feature helps shopkeepers take timely action, such as removing expired products or prioritizing the sale of items nearing expiry, thereby reducing wastage and preventing health risks.

5) Data Visualization (Charts and Analysis):
The application provides an analysis feature where users can view product data in graphical form using charts. These visualizations help users understand trends such as the number of expired products, products nearing expiry, and overall inventory status. This supports better decision-making and inventory planning.

6) User Interaction and Interface:
The system is designed with a simple and user-friendly interface, allowing users to easily add, view, update, and manage product information. The intuitive design ensures that even non-technical users can operate the application efficiently.
Overall, the methodology integrates barcode scanning, database management, automated processing, notification systems, and data visualization to create a complete and effective solution for expiry date monitoring and inventory management.

V. IMPLEMENTATION & RESULTS

The Expiry Date Checking System is implemented as an Android mobile application designed for efficient inventory and product expiry management. The implementation focuses on integrating barcode scanning, local database storage, automated expiry tracking, notification alerts, and data visualization in a single platform. The system is developed using Android Studio with Java as the core programming language and SQLite as the embedded database.

A. Implementation Details
The implementation of the system is divided into several functional modules:

1) Product Entry Module:
In this module, product details are added into the system either manually or through barcode scanning. The ZXing library is used to scan the product barcode, which automatically retrieves and stores product information in the database, reducing manual input errors.

2) Database Management Module:
SQLite database is used to store all product-related data such as product name, barcode ID, manufacturing date, and expiry date. The database supports fast data retrieval and efficient local storage without requiring any external server.

3) Expiry Monitoring Module:
This module continuously checks the expiry status of each product by comparing the current date with the stored expiry date. Based on this comparison, products are categorized into valid, near-expiry, and expired states.

4) Notification Module:

The system generates automatic notifications when a product is about to expire or has already expired. This ensures that the user (shopkeeper) is alerted in time to take necessary actions such as removing or selling the product.

5) Data Visualization Module:

MPAndroidChart library is used to display product statistics in graphical form. Charts such as bar charts and pie charts are used to represent expired products, active stock, and near-expiry items, helping users analyze inventory effectively.

B. Results and Discussion

After successful implementation, the system was tested with multiple product entries to evaluate its performance and accuracy. The results show that the system efficiently tracks product expiry dates and provides timely alerts without delay. Barcode scanning significantly reduces manual effort and increases data entry speed and accuracy.

The SQLite database ensures smooth data storage and retrieval, even with a large number of product entries. The notification system successfully alerts users before product expiry, helping in reducing wastage and improving inventory control. The graphical representation of data through MPAndroidChart provides clear insights into stock status, making decision-making easier for shopkeepers.

Overall, the system demonstrates high efficiency, reliability, and usability. It successfully achieves the objective of reducing product wastage, improving inventory management, and minimizing health risks associated with expired products.

VI. CONCLUSION

The Expiry Date Checking System is an effective Android-based application designed to assist shopkeepers in managing their inventory efficiently and reducing product wastage caused by expired goods. The system successfully integrates barcode scanning, SQLite database, notification alerts, and data visualization techniques to provide a complete and automated solution for product tracking and expiry management.

The use of ZXing library enables fast and accurate barcode scanning, which reduces manual data entry errors and improves operational efficiency. SQLite database ensures reliable local storage and quick retrieval of product information without the need for external servers. The notification system plays a crucial role in alerting users about products nearing expiry, helping in timely decision-making and preventing health risks associated with expired products.

Additionally, the implementation of MPAndroidChart enhances the system by providing graphical representation of inventory data, allowing users to analyze product status effectively. The system is user-friendly, lightweight, and suitable for small and medium-scale retail businesses.

Overall, the proposed system achieves its objectives of improving inventory management, minimizing product wastage, and enhancing health safety. It provides a practical and efficient solution for real-world retail environments and demonstrates how mobile technology can be used to solve everyday business problems.

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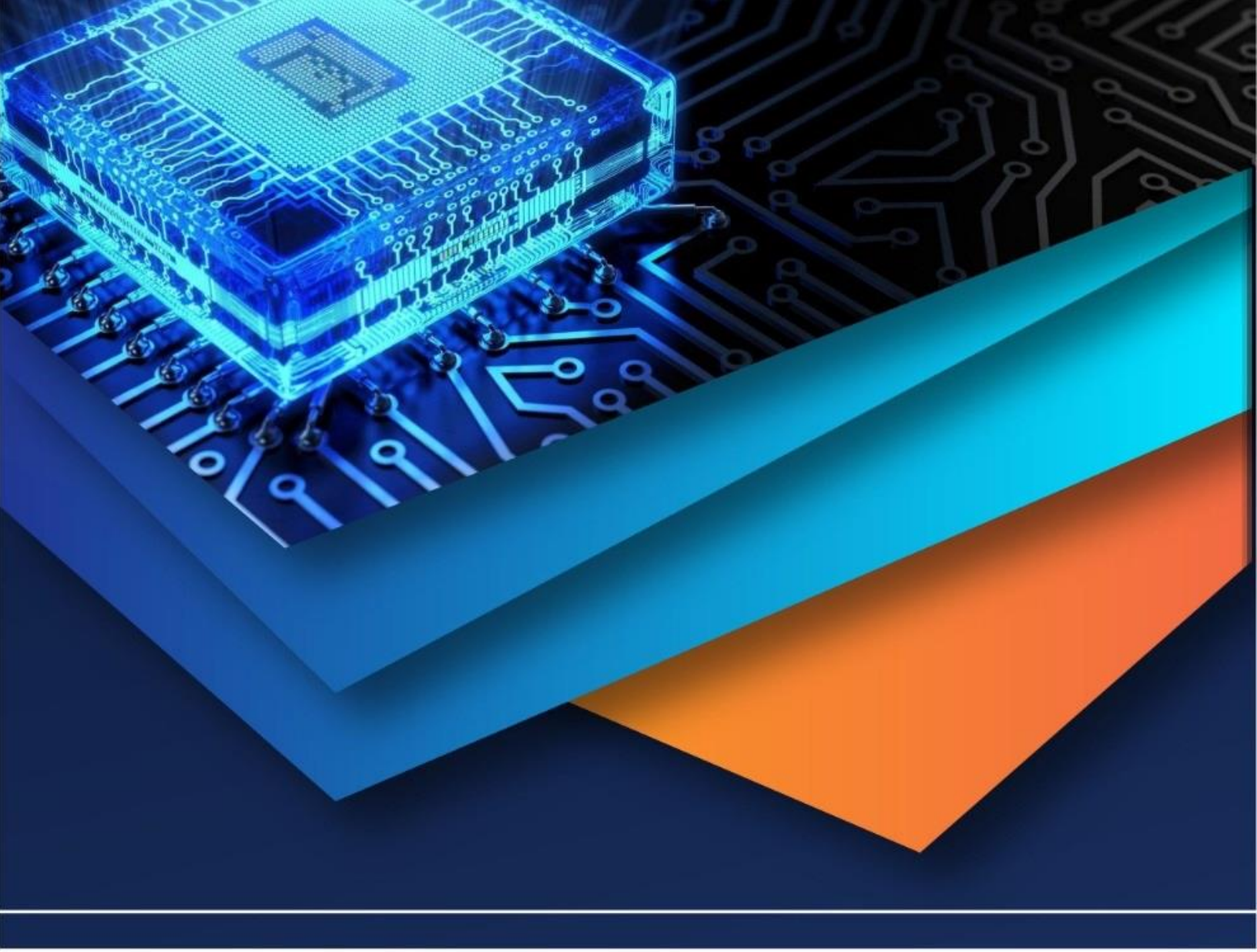
This project would not have been possible without the guidance and support of all the above-mentioned individuals.

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