# Technical Brief: Rapideye360

**Technical brief document**


***Innovative Inventory Management Tool***

**Document History**

| Author | Version | Date | Description | Comments |
|---|---|---|---|---|
| **Reshma Shaji** | **0.1** | **25-Feb-2024** | **Functionality and Technical document update** | |
| **Reshma Shaji** | **1.0** | **26-Feb-2024** | **API documentation and Potential Future applications update** | |

## I. Overview:

Rapideye360 is a revolutionary inventory management tool designed to transform the grocery sector by addressing the challenges associated with tracking and managing product expiry dates. Leveraging advanced algorithms and cloud-based technology, this solution offers a comprehensive approach to automate expiry date tracking, enhance marketing strategies, and optimise inventory management.

## II. Technical Details:

**Web Application Development:**

- Rapideye360 is implemented as an intuitive web application for seamless user interaction.
- Rapideye360 is implemented using Java with the Spring Boot framework for the backend, ensuring robust and scalable server-side operations, while the frontend is developed with React Native, delivering a responsive and cross-platform user interface for an optimal user experience.
- The web application is designed with a user-friendly interface to facilitate easy access and navigation for store clerks and managers.

**Cloud-Based NoSQL Database:**

- The solution relies on a cloud-based NoSQL database, MongoDB for storing and managing real-time data efficiently.

- MongoDB's flexibility, scalability, high performance, JSON-like documents, and community support make it a suitable choice for the Rapideye360 project, especially when dealing with the complexities of inventory management in the grocery sector.
- This architecture ensures scalability, flexibility, and accessibility for users across different locations.

**Automation and Algorithms:**

- Rapideye360 employs sophisticated algorithms to automate the tracking of product expiry dates.
- The system uses data analytics and heuristic approaches to predict and issue timely alerts to store managers a week before a product is set to expire.
- Rapideye360 provides intelligent pricing recommendations, utilising the product's price and historical selling details to determine optimal discounts for enhanced marketing strategies.
- Rapideye360 employs sophisticated algorithms to dynamically generate tasks, guiding store clerks in the systematic removal of expired products from designated racks, ensuring timely and efficient maintenance of inventory integrity.
- Rapideye 360 offers the flexibility of automated supplier reordering configurations, streamlining the procurement process by autonomously generating orders for products based on dynamic demand and operational needs.

**Real-Time Data Access:**

- The digitised approach enables real-time data access for store clerks, allowing them to promptly inform managers about product expiry.
- Centralised data storage ensures consistency and accuracy in inventory information.

**Code Architecture:**

The code architecture follows the Model-View-Controller (MVC) pattern. The brief overview of the code architecture with services, models, repositories, and controllers is as follows,

1. Models:

- Models represent the data structure and business logic of the application. They define the objects and entities used in the system.
- These classes encapsulate the properties and behaviour of the corresponding real-world entities.

2. Repositories:

- Repositories handle the interaction with the database. They are responsible for querying, updating, and persisting data.

3. Services:

- Services contain the business logic and act as an intermediary between controllers and repositories. They encapsulate complex operations and ensure separation of concerns.
- These services would interact with the repositories to fetch or persist data.

4. Controllers:

- Controllers handle incoming HTTP requests, process input data, invoke services, and return appropriate responses. They serve as the entry point for handling user interactions.
- They would call the corresponding services to execute the requested operations and return responses to the client.

**Security Overview:**

- JWT Token-Based Authentication:
  - Rapideye360 employs JWT (JSON Web Token) for user authentication. Upon successful login, the server issues a JWT token containing user information and privileges.
  - The token is securely transmitted to the client and subsequently included in the headers of API requests for subsequent authentication.

- Role-Based Access Control :
  - Rapideye360 implements RBAC to distinguish between clerks and managers.
  - Each user's JWT token includes role information, allowing the server to enforce role-based access control when processing requests.
- Data Encryption:
  - All communications between the client and the server are secured using HTTPS to encrypt data in transit, preventing unauthorised access or tampering.
  - Sensitive data, both at rest and in transit, is encrypted using industry-standard encryption algorithms.
  - Encryption is applied to database connections and other data transfer mechanisms within the application.

## III. Uses and Applications:

1. **Expiry Date Management:**

- Rapideye360 is specifically tailored for automating the tracking and management of product expiry dates.
- Enables store managers to take proactive measures to avoid waste and implement targeted marketing strategies.
- The system dynamically creates tasks for store clerks to remove any nearing expiration or overstocked items from the designated racks. This ensures that the store maintains a just-in-time inventory, minimising waste due to expired products and optimising stock levels to meet fluctuating customer demands.
- The integration of these features in Rapideye360 not only streamlines the procurement process but also enhances the overall efficiency of inventory management for fresh produce.

2. **Marketing Strategies:**

- Empowers store managers with the ability to apply targeted discounts to products nearing expiry, facilitating expedited sales.
- Enhances marketing decisions by providing insights into product shelf life and consumer behaviour.

3. **Inventory Optimization:**

- Facilitates dynamic demand-based restocking, optimising inventory levels to meet operational necessities.
- Centralised data and exclusive access to store managers empower informed decision-making to reduce waste and optimise profits.
- Rapideye360's automated supplier reordering and dynamic task generation can be applied in the context of managing fresh produce in grocery stores. The system continuously monitors the inventory levels of perishable items such as fruits and vegetables.
- When the inventory for a particular product falls below a predefined threshold (based on dynamic demand and operational needs), Rapideye360 autonomously generates an order to the supplier for a replenishment.

4. **Cloud-Based Accessibility:**

- Offers cloud-based accessibility for seamless data retrieval and management from any location.
- Supports multi-location grocery stores by providing a unified platform for inventory management.

5. **Dynamic Pricing for Seasonal Sales:**

- This application not only enhances marketing strategies but also ensures that the discounts align with the market trends and historical sales performance, optimising sales and customer satisfaction during seasonal events.
- Rapideye360's intelligent pricing recommendations can be effectively applied during seasonal sales promotions. Store managers can leverage this functionality to attract customers by offering targeted and competitive pricing on specific products that have demonstrated higher demand during similar periods in the past.

## IV. API Documentation:

| S.NO | Collection Tested | Description | Method | URL and Request Body | Expected Response |
|---|---|---|---|---|---|
| 1. | Discount | To create a discount | POST | • /discount/create<br>• {Category; Name; Brand; OriginalPrice; UPCID; aisleNumber; DiscountPrice;} | Returns the created discount |
| 2. | Discount | To list all discounted items | GET | • /discount/listAll | Returns all discounted items |
| 3. | Discount | To find if certain items are discounted or not based on their UPCID | GET | • /discount/UPCID/{UPCID} | Returns an item with a particular UPCID if it has a discount |
| 4. | Discount | To enable the Store Manager to Change the Discount for items. | PUT | • /discount/{UPCID}<br>• { discountPrice; } | Changes the discountPrice for the selected item by UPCID |
| 5. | Expiry | To create an expiry | POST | • /expiry/create<br>• {Category; Name; Brand; OriginalPrice; UPCID; aisleNumber; dateOfExpiry; } | Returns the created discount |
| 5. | Expiry | To know which products are expiring | GET | • /expiry/listAll<br>• None | Returns all the products nearing expiry |
| 6. | Expiry | To update the expiry date | PUT | • /expiry/{UPCID}<br>• None | Returns the updated products |
| 7. | Expiry | Find out the expiry date for certain products. | GET | • /expiry/UPCID/{UPCID} | Returns the object with expiry date. |
| 8. | Expiry | Find out which products are expiring within a particular date | GET | • /expirydate | Returns the products that are expiring within a particular date |
| 9. | Supplier | To update the supplier details | PUT | • /supplier/{brandName}<br>• {brandName:, supplierEmail:, supplierContact;} | Returns the updated supplier details |
| 10. | Supplier | Lets you add new businesses to place orders with | POST | • /supplier/create<br>• {brandName:, supplierEmail:, supplierContact;} | Returns the details of the added supplier |

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| 11. | Supplier | To list all the connected brands and their contact details. | GET | • /supplier/listAll<br>• None | Returns the details of all the brands. |
| 12. | Supplier | Provide details of suppliers who sell a particular brand. | GET | • /supplier/brandName{brandName}<br>• None | Returns the Suppliers who can provide a particular brand's products. |
| 13. | Product | Adding New Products to the catalog | POST | • /product/create<br>• All details of a Product | Returns the created product |
| 14. | Product | find product by their UPCID | GET | • /product/UPCID/{UPCID} | Returns the product detail. |
| 15. | Product | Get All Products | GET | • /product/all | Returns all the products |
| 16. | Product | Find Products using Brand Name | GET | • /product/Brand/{Brand} | Returns all the products of the brand |
| 17. | Product | find Products of the same category | GET | • /product/Category/{Category} | Returns all products with similar category. |
| 18. | Product | find Products using the Date Of Procurement | GET | • /product/procurementDate | Returns all products based on their date of procurement. |
| 19. | Product | Find Products nearing Expiry | GET | • /product/expiryDate | Returns products nearing expiry. |
| 20. | Product | Remove products from rack | GET | • /products/remove/id/rackNo | Returns 200 |
| 21 | Authentication | Register a store clerk | POST | • /register<br>• {Email; Password; Role;} | Returns jwt token |
| 22 | Authentication | login for store clerk | POST | • /login<br>• {Email; Password; Role;} | Returns jwt token |

## V. Potential Future Applications:

Rapideye360, with its advanced inventory management capabilities, can be extended to include several future applications that leverage data analytics, capacity planning, and more. Some potential future applications are,

1. **Predictive Analytics for Demand Forecasting:**

- Implement predictive analytics models to analyze historical sales data, seasonal trends, and other factors to forecast future demand accurately.
- Enable store managers to proactively adjust inventory levels based on predicted demand, reducing overstock or stockouts.

2. **Dynamic Pricing Optimization:**
   - Enhance the intelligent pricing module by incorporating dynamic pricing optimization algorithms.
   - Utilize real-time market data, competitor pricing, and customer behavior analysis to adjust pricing dynamically, maximizing revenue and competitiveness.
3. **Supply Chain Analytics:**
   - Integrate supply chain analytics to optimize the end-to-end supply chain process.
   - Analyze supplier performance, lead times, and costs to make informed decisions, ensuring a reliable and cost-effective supply chain.
4. **Customer Behavior Analysis:**
   - Utilize customer data to analyze purchasing patterns, preferences, and behavior.
   - Implement personalized marketing strategies, loyalty programs, and targeted promotions to enhance the customer experience and increase customer retention.
5. **Inventory Turnover Analysis:**
   - Develop analytics tools to monitor and analyze inventory turnover rates for different products.
   - Optimize inventory levels and reordering strategies based on historical turnover rates, ensuring efficient use of shelf space and capital.
6. **Capacity Planning and Resource Optimization:**
   - Implement capacity planning algorithms to optimize store layout and resource allocation.
   - Analyze foot traffic, sales patterns, and seasonal variations to efficiently allocate staff and resources during peak periods.
7. **Waste Reduction Strategies:**
   - Utilize analytics to identify patterns of product wastage and expiration.
   - Implement strategies to reduce waste, such as adjusting order quantities, optimizing product placement, and enhancing expiration date tracking.
8. **Employee Performance Analytics:**
   - Implement analytics tools to evaluate employee performance and efficiency.
   - Utilize data on tasks completed, response times, and accuracy to optimize staffing levels and provide targeted training.
9. **Market Basket Analysis:**
   - Implement market basket analysis to identify correlations between product purchases.
   - Optimize product placement and promotions based on insights gained from customer purchasing patterns.

## VI. Conclusion:

Rapideye360 is a powerful and innovative inventory management tool that combines automation, cloud-based technology, and real-time data access to revolutionise how grocery stores handle product expiry dates. By addressing the manual labour challenges prevalent in the industry, this solution empowers store managers, reduces waste, and enhances overall profitability through astute marketing strategies and optimised inventory management.