DebugOn-2025

Problem Statement 1 : Global Catalog Registry

Hackathon Objective:

To design an innovative and scalable Global Catalog Registry that fosters seamless catalog interoperability, enhances user experience, and optimizes catalog management for all ONDC participants.

Team Name:

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Team Members:

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MARKET ANALYSIS:

The rapidly growing e-commerce market, projected to reach $350 billion in India by 2030, presents a significant opportunity for ONDC to empower SMBs. However, fragmented catalog systems result in inefficiencies, high costs, and inconsistent user experiences for buyers and sellers. Existing solutions lack the interoperability, scalability, and flexibility required to address these challenges. A centralized Global Catalog Registry offers a transformative solution by eliminating redundancies, simplifying integration, and streamlining catalog management to enhance overall efficiency.

PROPOSED SOLUTION

We propose a unified platform with a centralized database, enabling an efficient M+N data transfer model that eliminates excess communication and simplifies operations for both buyers and sellers. The platform features robust authentication for enhanced security and dedicated interfaces tailored to buyer and seller needs. To empower sellers, we provide customizable templates for product information input, along with an edit option for flexibility in adding essential details. This solution promises to revolutionize catalog management, creating a more connected, efficient, and secure ONDC ecosystem.

INNOVATION AND UNIQUENESS

1) Centralized and Interoperable Design: A unified database enables seamless M+N data transfer, reducing communication overhead and enhancing efficiency across the ONDC ecosystem.
2) Customizable Seller Templates: Provides dynamic templates with edit options, empowering sellers to tailor product information with ease and flexibility.
3) Tailored User Experiences: Distinct, purpose-driven interfaces for buyers and sellers ensure usability while prioritizing security through advanced authentication mechanisms.

Detailed Market Analysis: Page-(2-3) - (Gdrive Link given in references)

TECHNOLOGIES USED AND IMPLEMENTATION

HTML CSS

FRONTEND

REST API

BACKEND

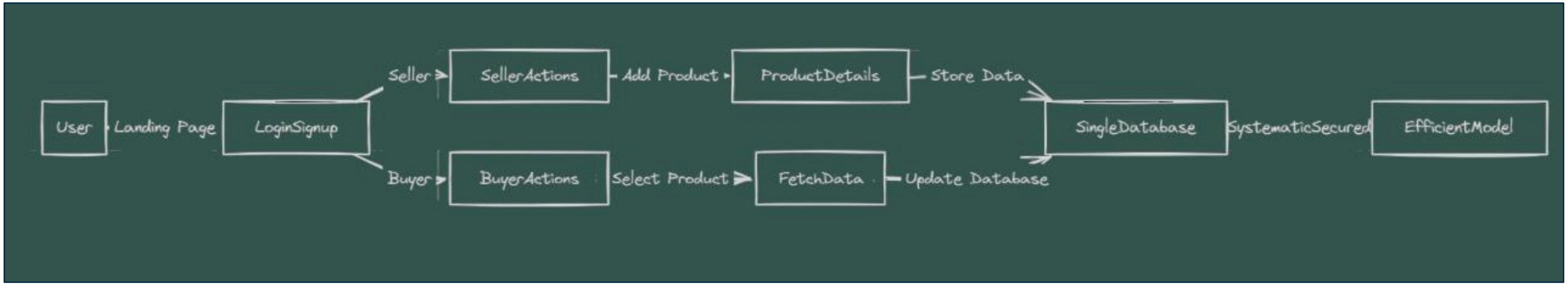
mongoDB Cloudinary

DATABASE & STORAGE

twilio Nodemailer

SMS & MAIL GATEWAY

PROJECT FLOW



Detailed Project Flow: Page-5- (Gdrive Link given in references)

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TECHNICAL ARCHITECTURE

❖ **Centralized Global Catalog Registry (GCR):**

- Reduces redundancy and enhances interoperability by centralizing product data.
- Facilitates seamless data transfer with the M+N model.

❖ **Core Components:**

- Data Layer: Uses Cloudinary(Image Storage), MongoDB (unstructured data)
- Integration Layer: REST APIs, event-driven messaging(NodeMailer &Twillo), and OAuth2.0 for secure access.
- Processing Layer: Data validation, dynamic templates for sellers, and Elasticsearch for fast search.

❖ **Key Features:**

- Interoperability: Ensures smooth integration across platforms.
- Scalability: Microservices architecture for flexible scaling.
- Cost Optimization: Centralized catalog reduces redundant processing and storage.

TECHNICAL FEASIBILITY

The solution leverages existing technologies (databases, APIs, event-driven systems) to create an efficient and scalable system. It is technically viable within the ONDC ecosystem due to its:

❖ **Ease of Integration**: Platforms can integrate seamlessly via APIs without modifying core systems.

❖ **Low Overhead:** Centralized management and caching minimize resource usage.

❖ **High Security:** Authentication ensures safe data exchange across platforms.

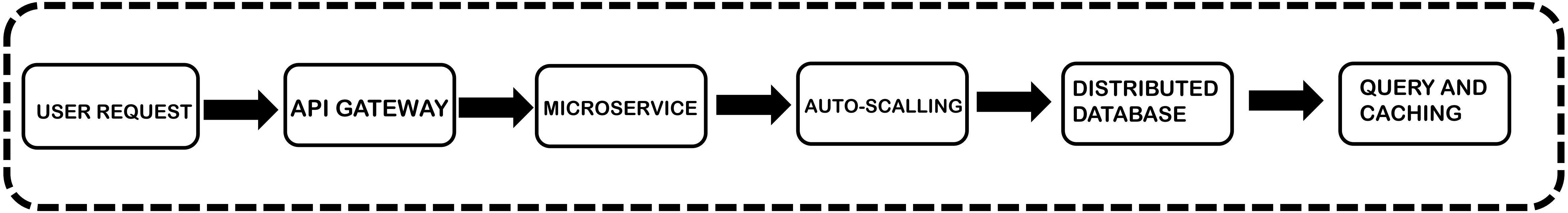
❖ **Future-Proofing:** The architecture supports modular upgrades for additional features like advanced analytics or AI-driven personalization.

The design aligns perfectly with the ONDC's goals to enhance catalog interoperability, streamline operations, and provide an optimal experience for buyers and sellers.

SCALABILITY

- **Microservices Architecture:** Each service (e.g., catalog management, data updates) can be scaled individually, ensuring that performance remains unaffected even when one component experiences high demand. This allows for flexible scaling and optimized resource usage across the entire system.
- **Auto-scaling:** Leveraging cloud services, the system can automatically scale its infrastructure based on demand (e.g., during traffic spikes), ensuring that resources are added or removed in real time without manual intervention.
- **Distributed Databases:** The system utilizes a combination of relational (PostgreSQL) and NoSQL (MongoDB) databases that can scale horizontally. As data volume grows, additional database nodes can be added to maintain optimal read/write speeds without compromising performance.
- **Caching Mechanisms (Redis):** Frequently accessed catalog data is stored in memory using Redis, which minimizes database queries and accelerates response times for high-demand data, such as product details or inventory information, ensuring the system operates efficiently even under heavy load.

These features make the solution adaptable to varying data loads, offering seamless scalability while maintaining a high level of performance and responsiveness



USER REQUEST → API GATEWAY → MICROSERVICE → AUTO-SCALLING → DISTRIBUTED DATABASE → QUERY AND CACHING

ALIGNMENT WITH ONDC’S GOALS

The proposed Global Catalog Registry (GCR) solution exemplifies a strategic alignment with ONDC’s mission to foster a unified, interoperable, and efficient digital commerce ecosystem. Key elements of this alignment are as follows:

❖ **Facilitating Seamless Catalog Interoperability:**
- Centralized catalog storage and standardized management ensure cohesive data exchange, aligning with ONDC’s vision of an interconnected marketplace.

❖ **Scalability and Operational Excellence:**
- The microservices architecture and advanced technologies like auto-scaling enhance adaptability and optimize resource utilization.

❖ **Enhanced User Experience:**
- Customizable templates and secure user interfaces provide consistency and reliability for buyers and sellers.

❖ **Empowering SMBs:**
- Simplified integration processes enable small and medium businesses to participate effectively in ONDC’s inclusive ecosystem.

❖ **Optimized Resource Utilization:**
- Centralized operations reduce redundancy and lower costs, supporting a sustainable and economically efficient platform.

❖ **Future-Ready Design:**
- The modular architecture supports seamless integration of AI-driven personalization and advanced analytics for long-term innovation.

BENEFITS OF SOLUTION

- **Interoperability:** Seamless buyer-seller integration, reducing fragmentation.
- **Centralized Data:** Minimizes redundancy with a single source of truth.
- **Efficient Model:** M+N model eliminates repetitive data entry.
- **Customizable Templates:** Enables flexible and dynamic catalog creation.
- **Secure Access:** OAuth2/JWT ensures safe, authorized interactions.
- **Real-Time Updates:** Event-driven messaging keeps data current.

IMPACT ON TARGET AUDIENCE

For Sellers:	For Buyers:	For Platforms:
Simplifies catalog creation with templates, increases visibility across platforms, and reduces storage costs.	Provides consistent product information, faster searches, and real-time updates for better decision-making.	Enables seamless integration, scalability, and improved collaboration within the ONDC ecosystem.

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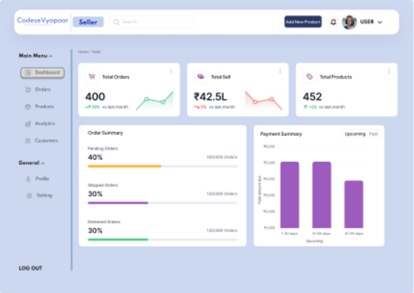
MOCKUP(WIREFRAMES)

FOR SELLERS


CodeseVyapaar Seller

USER

Main Menu

Dashboard

Orders

Products

Analytics

Customers

General

Profile

Setting

LOG OUT

Total Orders 400

Total Sell ₹42.5L

Total Products 452

Order Summary

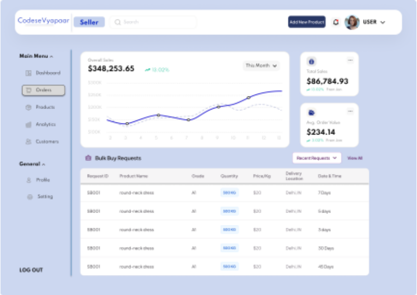
Pending Orders 40%

Shipped Orders 30%

Delivered Orders 30%

Payment Summary

HOME DASHBOARD


CodeseVyapaar Seller

USER

$348,253.65

This Month

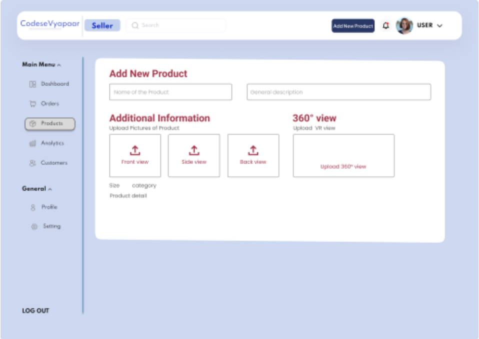
$86,784.93

$234.14

Bulk Buy Requests

LOG OUT

ORDERS SECTION


CodeseVyapaar Seller

Add New Product

USER

Main Menu

Dashboard

Orders

Products

Analytics

Customers

General

Profile

Setting

LOG OUT

Add New Product

Name of the Product

General description

Additional Information

Upload Pictures of Product

360° view

Upload VR view

Front view

Side view

Back view

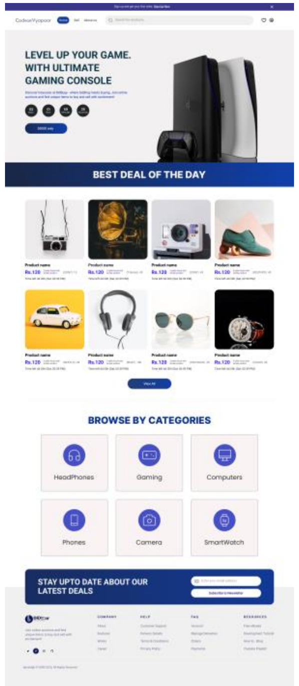
Upload 360° view

Size category

Product detail

ADD PRODUCT PAGE

FOR BUYERS


LEVEL UP YOUR GAME. WITH ULTIMATE GAMING CONSOLE

BEST DEAL OF THE DAY

BROWSE BY CATEGORIES

HeadPhones

Gaming

Computers

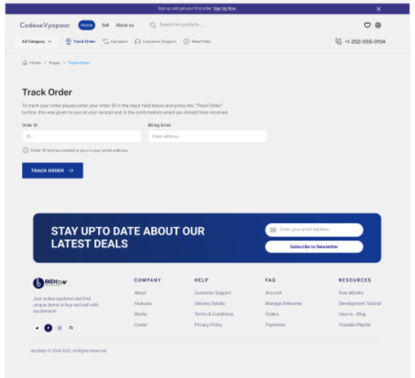
Phones

Camera

SmartWatch

STAY UPTO DATE ABOUT OUR LATEST DEALS

HOME PAGE FOR BUYER


CodeseVyapaar

Track Order

TRACK ORDER

STAY UPTO DATE ABOUT OUR LATEST DEALS

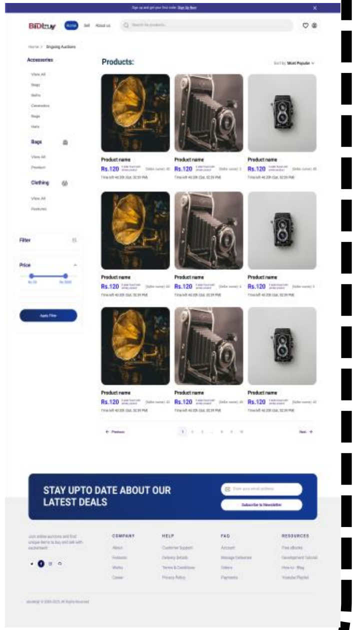
COMPANY

HELP

FAQ

RESOURCES

PAYMENT PAGE FOR BUYER


Products:

Product name

Rs.120

STAY UPTO DATE ABOUT OUR LATEST DEALS

PRODUCT PAGE

All Detailed Designs: Click Here (Gdrive Link)

POTENTIAL RISKS

- **Data Redundancy and Inconsistency**
  Risk: Poor synchronization may cause duplicated or inconsistent data.
  Impact: Reduces system reliability and creates confusion in buyer-seller interactions.
- **Scalability Challenges**
  Risk: High traffic could slow or crash the system.
  Impact: Poor user experience and potential loss of transactions.
- **Integration Complexity**
  Risk: Diverse systems may cause compatibility issues.
  Impact: Delayed adoption and increased development overhead.
- **Security Vulnerabilities**
  Risk: Unauthorized access could lead to data breaches.
  Impact: Loss of trust and potential regulatory penalties.
- **High Initial Costs**
  Risk: Development expenses could exceed budgets
  Impact: Could lead to delays or compromise on critical features
- **Data Privacy and Compliance**
  Risk: Non-compliance may lead to legal penalties.
  Impact: Risk of fines, lawsuits, and reputational damage.

HOW TO OVERCOME?

Data Redundancy and Inconsistency	Implement data normalization techniques to ensure uniformity.
System Scalability Challenges	$\frac{\text{Resource Utilization}}{\text{Total Capacity}}$ Maintain $R \leq 0.7$ for optimal performance.
Integration Complexity	Developing RESTful APIs with clear documentation for standardized communication.
Security Vulnerabilities	Implementing OAuth 2.0 authentication and end-to-end encryption.
High Initial Costs	$\text{ROI} = \frac{\text{Net Benefits}}{\text{Total Costs}}$ Ensure $ROI > 1$ before proceeding with large-scale investments.

RESEARCH AND REFERENCES

"India's e-commerce market is projected to grow substantially by 2030, with digital penetration reaching deeper into tier-2 and tier-3 cities. However, businesses face challenges due to fragmented digital infrastructure, lack of interoperability, and integration barriers between platforms, particularly in catalog management."

~ Indian Journal of Economics and Business

This section includes a detailed analysis of the market, conducted by our team, to gain insights into the challenges faced by buyer and seller applications in catalog management. Additionally, we have referenced key research papers and technical resources to validate our approach, along with visual mockups and architecture diagrams that illustrate the functionality and scalability of the proposed Global Catalog Registry solution.

CLICK HERE - LINK TO REFERENCES

LINK TO DETAILED DESIGNS

LINK TO VIDEO TUTORIAL TO RUN CODEBASE