OPTIMIZATION OF MYSQL DATABASE IN THE DEVELOPMENT OF SOLO BATIK MALL

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ABSTRACT

This study aims to design and optimize a MySQL database for an online batik mall system to support the digitalization of batik micro, small, and medium enterprises (MSMEs). The research employed three stages: analysis, design, and implementation. The analysis phase identified actors (sellers, buyers, and administrators) and business process needs. The design stage focused on database structures and optimization strategies, including indexing, query optimization, caching, normalization, and denormalization. The implementation involved building the database, applying optimization techniques, and evaluating performance. The optimization of MySQL significantly improved query execution speed, reduced system response time, and enhanced resource efficiency. The system was able to manage transactions, product searches, and reporting more effectively, supporting both operational and strategic needs of the online batik mall. The MySQL-based online batik mall system provides an efficient solution for data management, thereby enhancing the competitiveness of batik MSMEs in the digital era.

KEYWORDS database, MySQL, online batik mall

INTRODUCTION

The development of information technology has had a significant impact on various sectors, including micro, small, and medium enterprises (MSMEs). In the digital era, MSMEs are required to not only rely on traditional marketing methods but also utilize technology to remain competitive (Dariz Radyananda Barus et al., 2023). One relevant step is the development of an online batik mall, a digital platform that connects batik outlet sellers with buyers from across Indonesia. The presence of this online mall is expected to increase the visibility of batik products while expanding marketing reach (Kismo & Lahindah, 2024). The use of information technology, particularly through website creation, facilitates the efficient collection, storage, and management of batik sales and purchase data (Suhartini et al., 2021). In developing an online batik mall, data management processes are increasingly crucial, particularly in presenting sales and purchase transaction information

for optimal performance. The information presented is previously stored in a database (Lamb et al., 1991). A good database is efficient in its use of fields, data types, and storage length. The implementation of a batik data management website uses the PHP programming language and a MySQL database.

The use of website technology provides easy access to batik information such as the homepage, categories, products, tourism services, orders, transaction history, and more (Amin et al., 2012). PHP is a popular website programming language that offers flexibility in developing dynamic websites. As a relational database management system, MySQL provides a structured framework for storing batik data efficiently and securely (Abidin et al., 2024). The successful implementation of an online batik mall website will bring significant benefits not only to buyers and sellers but also to service providers as online mall administrators. The use of online malls as a form of digitizing batik MSMEs is based on the need to provide an integrated platform where sellers can display their products more widely, and buyers can easily make transactions anytime and anywhere.

However, the success of this system depends not only on the database, but also on MySQL optimization so that data retrieval, transactions, and services can run quickly, efficiently, and can handle a growing number of users (Zulkifli, 2023). The mallonline database is implemented in MySQL, named mallonline.sql, which consists of nine tables: det_orders, category, cart, orders, product, review, store, user, and variant. Database selection is a vital aspect in designing an online mall system. MySQL was chosen because it is known as an open source database management system that is reliable, stable, and efficient in managing large amounts of data (Kalsum Siregar et al., 2024). In addition, MySQL also has extensive community support and is compatible with various application development frameworks. From the problem description above, the problem formulation can be drawn, namely how to design and optimize the MySQL database in an online mall system to support the operation of an online batik mall. The purpose of this research is to analyze and design an online mall database with 9 tables that are suitable to support the online batik mall system.

RESEARCH METHOD

There are three research methods used in this study: analysis, design, and MySQL implementation (Arief & Sugiarti, 2022). The following image shows the system development methods used in this study.

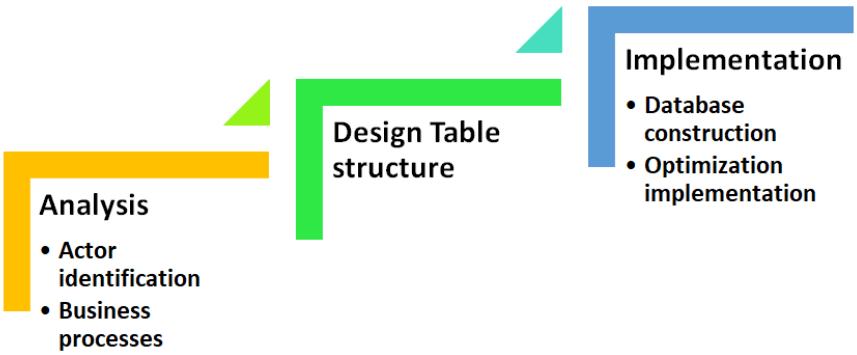

Figure 1. System Development Method

1. Analysis

The analysis phase was conducted to identify the system requirements for the online batik mall, particularly regarding the database aspect (Aziiz et al., 2024). The analysis included identifying sellers, buyers, and administrators. Business process requirements were identified, including user registration, product catalog management, transactions, and payments (Yanuar & Informaika, 2025). Next, an analysis was conducted of the mallonline.sql database requirements, which consists of nine tables, with optimization of the most frequently used queries to improve database efficiency.

2. Design Table Structure

The design phase focuses on designing the database structure and optimization strategies (Kencana Dewi et al., 2024). This phase involves designing tables and relationships between them, as well as defining data integrity rules. Furthermore, a MySQL optimization strategy is developed, including indexing of critical columns, designing more efficient queries, and considering normalization and denormalization to balance data integrity and system performance.

3. Implemetation

The final stage is implementation, which involves creating the mallonline.sql database based on the design. At this stage, MySQL optimization techniques are applied to priority tables and queries, followed by database performance testing before and after optimization using specific transaction scenarios. Test results are evaluated based on query execution speed, system response time, and resource efficiency, thus determining the effectiveness of MySQL optimization in supporting the performance of the online batik mall.

RESULT AND DISCUSSION

1. Analysis

a. Actor Identification

Identification of actors can be seen in the table below.

Table 1. Actor Identification

Actor	Primary Needs	Role in the System
1. Seller The seller is an MSME or batik outlet that uses the system to market its products.	✓ Can register seller account. ✓ Manage product catalog (add, change, delete batik products). ✓ View and manage orders from buyers. ✓ Monitor sales and revenue reports.	Supplying batik products, maintaining stock availability, and ensuring smooth transactions with buyers
2. Buyer Buyers are general users from the Indonesian community who search for and purchase batik products through the platform.	✓ Buyer account registration and login. ✓ Search and browse the batik product catalog by category, price, or motif. ✓ Make orders and payments digitally. ✓ View transaction history and order status.	As the end consumer who is the main target of digitalization of batik MSMEs
3. Admin Admin is a system manager whose job is to ensure that all activities on the platform run smoothly.	✓ Manage user data (sellers and buyers). ✓ Verify the seller account. ✓ Monitor transactions and financial reports.	Be a liaison between sellers, buyers, and platform managers so that the system runs safely, orderly, and according to regulations.

	✓ Manage general content (promotional information, policies, or related news).

b. Business Processes

The business process at Batik Online Mall begins with the registration and login phase. At this stage, buyers and sellers register their accounts through the system, while the admin has the authority to verify seller accounts to enable them to use the store management features. Once verified, sellers can fully manage their digital stores. Next, sellers can manage products by adding batik products to the system, along with details such as name, category, price, stock, description, and image. The entered product data is stored in the database and displayed in the product catalog. Sellers also have access to update or delete products as needed.

On the buyer side, the business process continues with the product search and ordering phase. Logged-in buyers can browse the catalog by category, motif, and price. Selected products are added to their shopping cart, and they can then proceed to checkout to place their order. The system records the order along with details such as product type, quantity, and price. The next phase is the order and payment process. Buyers complete the transaction using available digital payment methods, such as bank transfers or digital wallets. The system records the payment status from pending to successful. Afterward, the seller receives a notification of the new order and prepares the product for shipment.

The process continues with the shipping and confirmation phase. The seller ships the item to the buyer, and the order status is updated from "shipped" to "completed" after the buyer receives the product and confirms receipt. Finally, the system provides reporting and monitoring. Sellers can automatically view sales reports over a specific period to monitor their business performance. The admin acts as an overall supervisor, managing seller and buyer data, monitoring transactions, and organizing promotions to support the marketing of batik products.

4. Design Table Structure

Table structure design is a crucial step in developing an online batik mall system because it serves as the primary foundation for data storage and management. At this stage, each table is designed to represent entities involved in the business process, such as users, products, transactions, and sales reports. Relationships between tables are organized through clear relationships to ensure data integration and reduce redundancy. Therefore, table structure design not only determines the completeness of the stored information but also impacts the efficiency, consistency, and overall system performance.

#	Name	Type	Collation	Attributes	Null	Default
1	id_kategori	int(11)			No	*None*
2	kategori	varchar(50)	utf8mb4_general_ci		No	*None*
3	del	enum('0', '1')	utf8mb4_general_ci		No	0

Figure 2. *Kategori* Table

	#	Name	Type	Collation	Attributes	Null	Default
☐	1	id_keranjang	int(11)			No	None
☐	2	id_user	int(11)			No	None
☐	3	id_produk	int(11)			No	None
☐	4	id_varian	int(11)			No	None
☐	5	jumlah	int(11)			No	None
☐	6	del	int(11)			No	None

Figure 3. *Keranjang* Table

	#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
☐	1	id_produk	int(11)			No	None	AUTO_INCREMENT	Change
☐	2	id_toko	int(11)			No	None		Change
☐	3	id_kategori	int(11)			No	None		Change
☐	4	nama_produk	varchar(255)	utf8mb4_general_ci		No	None		Change
☐	5	deskripsi_produk	text	utf8mb4_general_ci		No	None		Change
☐	6	deskripsi_lengkap	text	utf8mb4_general_ci		No	None		Change
☐	7	tgl_input	datetime			No	None		Change
☐	8	del	enum('0', '1')	utf8mb4_general_ci		No	0		Change

Figure 4. *Produk* Table

	#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
☐	1	id_review	int(11)			No	None	AUTO_INCREMENT	Change
☐	2	id_barang	int(11)			No	None		Change
☐	3	id_user	int(11)			No	None		Change
☐	4	bintang	int(1)			No	None		Change
☐	5	review	varchar(255)	utf8mb4_general_ci		No	None		Change
☐	6	del	enum('0', '1')	utf8mb4_general_ci		No	0		Change

Figure 5. *Review* Table

	#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
☐	1	id_toko	int(11)			No	None	AUTO_INCREMENT	Change
☐	2	id_user	int(11)			No	None		Change
☐	3	nama_toko	varchar(255)	utf8mb4_general_ci		No	None		Change
☐	4	deskripsi	varchar(255)	utf8mb4_general_ci		No	None		Change
☐	5	jalan	varchar(255)	utf8mb4_general_ci		No	None		Change
☐	6	rt	int(4)			No	None		Change
☐	7	rw	int(4)			No	None		Change
☐	8	kelurahan	int(4)			No	None		Change
☐	9	kecamatan	int(4)			No	None		Change
☐	10	kota	int(4)			No	None		Change
☐	11	provinsi	int(4)			No	None		Change
☐	12	kodepos	int(5)			No	None		Change
☐	13	del	enum('0', '1')	utf8mb4_general_ci		No	0		Change

Figure 6. *Toko* Table

	#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
☐	1	id_user	int(11)			No	None	AUTO_INCREMENT	Change
☐	2	nama	varchar(50)	utf8mb4_general_ci		No	None		Change
☐	3	telepon	varchar(15)	utf8mb4_general_ci		No	None		Change
☐	4	email	varchar(50)	utf8mb4_general_ci		No	None		Change
☐	5	password	varchar(25)	utf8mb4_general_ci		No	None		Change
☐	6	jalan	varchar(255)	utf8mb4_general_ci		No	None		Change
☐	7	rt	int(2)			No	None		Change
☐	8	rw	int(2)			No	None		Change
☐	9	kelurahan	int(8)			No	None		Change
☐	10	kecamatan	int(8)			No	None		Change
☐	11	kota	int(8)			No	None		Change
☐	12	provinsi	int(8)			No	None		Change
☐	13	kodepos	int(5)			No	None		Change
☐	14	del	enum('0', '1')	utf8mb4_general_ci		No	0		Change

Figure 7. *Users* Table

	#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
☐	1	id_varian	int(11)			No	None	AUTO_INCREMENT	Change
☐	2	id_produk	int(11)			No	None		Change
☐	3	nama_varian	varchar(127)	utf8mb4_general_ci		No	None		Change
☐	4	harga	int(11)			No	None		Change
☐	5	stok	int(11)			No	None		Change
☐	6	berat	decimal(2,2)			No	None		Change
☐	7	foto	varchar(255)	utf8mb4_general_ci		No	None		Change
☐	8	del	enum('0', '1')	utf8mb4_general_ci		No	None		Change

Figure 8. *Varian* Table

5. Implementation

The database implementation in the online mall was carried out to manage user, product, transaction, and payment data in an integrated manner. The table structure was designed with normalization for efficiency, reduced redundancy, and supported security through authentication and access control. With this database, the system is able to provide fast, accurate service and simplify business management for both sellers and administrators.

a. Database Contruction

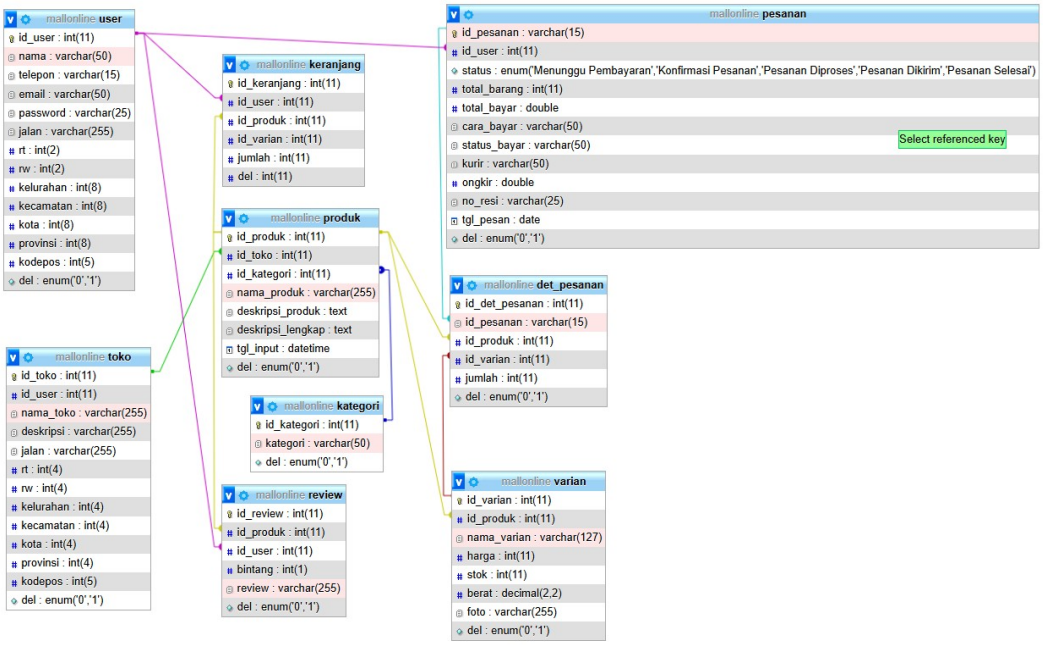

Figure 9. Database Contruction

b. Optimazation Implementation:

1) Product Search

Query:

```
SELECT produk_id, nama_produk, harga, stok, kategori
FROM produk
WHERE nama_produk LIKE '%batik%'
   OR kategori LIKE '%tulis%'
ORDER BY tanggal_input DESC
LIMIT 20;
```

Optimization Strategy:

```
Create a FULLTEXT index on product_name and category.
ALTER TABLE products ADD FULLTEXT (product_name, category);
Use MySQL FULLTEXT Search (MATCH ... AGAINST) instead of LIKE
for faster searches.
Add an index on input_date to speed up sorting.
Implement query caching for popular keywords (e.g., "batik
tulis").
```

2) Product Details + Seller Info

Query:

```
SELECT p.produk_id, p.nama_produk, p.harga, p.stok,
p.deskripsi, u.nama AS nama_penjual, u.email
FROM produk p
JOIN user u ON p.penjual_id = u.user_id
WHERE p.produk_id = 123;
```

Optimization Strategy:

Index on seller_id (FK in the products table).
Use a covering index (product_id, seller_id).
Implement caching for frequently viewed product details (e.g., best-selling products)..

3) Buyer Order

Query:

```
SELECT ps.pesanan_id, ps.tanggal_pesanan, ps.total_harga,
ps.status_pesanan, dp.produk_id, pr.nama_produk, dp.jumlah,
dp.subtotal
FROM pesanan ps
JOIN detail_pesanan dp ON ps.pesanan_id = dp.pesanan_id
JOIN produk pr ON dp.produk_id = pr.produk_id
WHERE ps.pembeli_id = 45
ORDER BY ps.tanggal_pesanan DESC;
```

Optimization Strategy:

Index on buyer_id + order_date.
Use a composite index (buyer_id, order_id) for the join.
Apply pagination (LIMIT ... OFFSET) to avoid loading all the data at once.
Cache recent transaction history (e.g., the most recent 5-10 transactions).

4) Sales Report

Query:

```
SELECT p.penjual_id, u.nama AS penjual,
       COUNT(ps.pesanan_id) AS total_transaksi,
       SUM(ps.total_harga) AS total_pendapatan
FROM pesanan ps
JOIN detail_pesanan dp ON ps.pesanan_id = dp.pesanan_id
JOIN produk p ON dp.produk_id = p.produk_id
JOIN user u ON p.penjual_id = u.user_id
WHERE ps.status_pesanan = 'selesai' AND ps.tanggal_pesanan
       BETWEEN '2025-01-01' AND '2025-01-31'
GROUP BY p.penjual_id;
```

Optimization Strategy:

Index on order_status and order_date.
Use a composite index (seller_id, order_date, order_status).
Create a daily report summary table (a mini data warehouse) to avoid repetitive, heavy queries.
Implement a materialized view (or simulate it with a separate table) for monthly reports.

5) Admin Monitoring (Daily Transactions)

Query:

```
SELECT DATE(ps.tanggal_pesanan) AS tanggal,
       COUNT(*) AS jumlah_transaksi,
       SUM(ps.total_harga) AS omzet
FROM pesanan ps
WHERE ps.status_pesanan = 'selesai'
GROUP BY DATE(ps.tanggal_pesanan)
ORDER BY tanggal DESC;
```

Optimization Strategy:

Index on (order_status, order_date).
Use RANGE partitioning on order_date (e.g., by month/year).
Store daily transaction data in an aggregate table (daily_report) to speed up monitoring queries.
Implement result caching for the admin dashboard.

CONCLUSION

An online batik mall designed with a MySQL database consisting of nine tables: det_orders, categories, cart, orders, products, reviews, stores, users, and variants, has been proven to optimize transaction management, product searches, and sales reports efficiently, thereby supporting the digitalization of batik MSMEs. Query, indexing, and caching optimizations have successfully improved system performance and simplified interactions between sellers, buyers, and administrators. Further research can develop more diverse data security features and digital payment integrations to enhance the system's reliability and ease of use. Furthermore, the application of big data analytics or machine learning can be considered to support more targeted product recommendations and marketing strategies.

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