**Brief Report Summary of Findings**

The MongoDB-based e-commerce project highlights effective schema design, advanced querying, real-time monitoring, and transactional capabilities. Below is a summary of the findings:

**Schema Design**

* **Customers Collection:**
  + Embedded schema used to store address details directly within the customer document for simplicity and close coupling.
* **Products Collection:**
  + Referenced schema chosen for centralized management of product details, ensuring consistency across orders and minimizing redundancy.
* **Orders Collection:**
  + Referenced schema facilitates efficient querying of customer orders and avoids duplication.
* **Order Items Collection:**
  + Referenced schema supports the many-to-many relationship between orders and products, allowing scalability.

Indexes on frequently queried fields like “customer\_id”, “product\_id”, and “order\_id” significantly improve query performance.

**Queries and Insights**

1. **Product Categories Generating Highest Revenue:**
   * Categories like **Appliances** and **Electronics** generate the most revenue, indicating strong customer demand for these products.
   * Example: Appliances generated a total revenue of $25,272.
2. **Average Delivery Time for Orders:**
   * The average delivery time for delivered orders is approximately **3.88 days**, suggesting efficient logistics.
3. **States with the Highest Number of Customers:**
   * **Arizona** leads with 4 customers, followed by several states with 2 customers each.
4. **Top 3 Most Expensive Products in Each Order:**
   * Detailed insights provided on the most expensive products per order, helping identify high-value items frequently purchased.

**Advanced Features**

1. **Transactions:**
   * Atomic updates across “orders”, “order\_items”, and “products” collections ensure data consistency.
   * Example: Simulating an order creation process updates stock quantities and creates new order documents in a single transaction.
2. **Real-Time Monitoring:**
   * Change streams monitor real-time modifications in the orders collection, allowing immediate detection of new orders or updates.
3. **Schema Validation:**
   * Applied validation ensures that all products have positive prices and stock quantities, maintaining data integrity.

**Conclusion**

The project demonstrates the robust capabilities of MongoDB in handling e-commerce workflows, including flexible schema design, efficient querying, and advanced features like transactions and change streams. These features enable scalable and reliable data operations essential for modern applications.

For further analysis or additional functionality, feel free to explore the provided scripts and queries.