🎁 Gift Cards Database

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Course Work Project  
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# Table of Contents

* 1. Project Overview
* 2. Technical Architecture
* 3. Database Design
* 4. ETL Process
* 5. SQL Queries Analysis
* 6. Power BI Dashboard
* 7. Implementation Details
* 8. Screenshots and Documentation
* 9. Conclusion

# 1. Project Overview

This course work project implements a complete data analytics solution for a gift card system. The project demonstrates the implementation of OLTP (Online Transaction Processing) and OLAP (Online Analytical Processing) databases, ETL (Extract, Transform, Load) processes, SQL queries, and Power BI visualizations.

## 1.1 Project Objectives

* Design and implement OLTP database with normalized structure
* Create OLAP data warehouse with star schema
* Implement ETL process for data migration
* Develop analytical SQL queries for both OLTP and OLAP
* Create interactive Power BI dashboard with visualizations
* Provide comprehensive documentation and screenshots

# 2. Technical Architecture

The project follows a modern data architecture pattern with separate OLTP and OLAP systems:

## 2.1 System Components

* OLTP Database (PostgreSQL): Normalized structure for transaction processing
* OLAP Data Warehouse (PostgreSQL): Denormalized structure for analytical queries
* ETL Process: Data extraction, transformation, and loading
* Power BI Dashboard: Interactive visualizations and reporting
* Documentation: Comprehensive project documentation and screenshots

# 3. Database Design

## 3.1 OLTP Database (giftcards\_oltp)

The OLTP database follows Third Normal Form (3NF) normalization for efficient transaction processing. It contains 8 tables designed to handle day-to-day operations.

* Users: Customer information and profiles
* GiftCardTypes: Different types of gift cards available
* GiftCards: Individual gift card instances
* TransactionTypes: Types of transactions (purchase, usage, etc.)
* MerchantCategories: Categories of merchants
* Merchants: Individual merchant information
* Transactions: Transaction records
* Promotions: Promotional campaigns and offers

Reference: See screenshot "all\_tables.png" for complete database structure visualization.

## 3.2 OLAP Data Warehouse (giftcards\_dwh)

The OLAP data warehouse uses a star schema design optimized for analytical queries. It includes Slowly Changing Dimension (SCD) Type 2 implementation for historical tracking.

### Dimension Tables:

* DimUser: User dimension with SCD Type 2
* DimGiftCard: Gift card dimension with SCD Type 2
* DimMerchant: Merchant dimension
* DimMerchantCategory: Merchant category dimension
* DimDate: Date dimension for time-based analysis
* DimPromotion: Promotion dimension

### Fact Tables:

* FactCardSales: Sales transactions
* FactCardUsage: Usage transactions

### Bridge Table:

* BridgeUserPromotion: Many-to-many relationship between users and promotions

Reference: See screenshots "oltp.png" and "olap.png" for database schema diagrams.

# 4. ETL Process

The ETL (Extract, Transform, Load) process is implemented to migrate data from the OLTP system to the OLAP data warehouse. The process includes data validation, transformation, and loading.

## 4.1 ETL Components

* Data Loading (LoadData.psql): Initial data loading from CSV files to OLTP
* ETL Script (ETL.sql): Main ETL process for OLTP to OLAP migration
* Export Script (csv\_to\_excel.py): Data export for Power BI consumption

## 4.2 ETL Process Flow

* Extract: Read data from OLTP tables
* Transform: Apply business rules and data transformations
* Load: Insert transformed data into OLAP tables
* Validate: Ensure data quality and integrity

# 5. SQL Queries Analysis

## 5.1 OLTP Queries

Three analytical queries were developed for the OLTP database to provide business insights from transactional data.

* User Analysis: Customer spending patterns and transaction counts
* Sales Analysis: Gift card sales performance by time period
* Merchant Analysis: Transaction volume and revenue by merchant category

Reference: See screenshot "sql\_queries\_oltp\_results.png" for query execution results.

## 5.2 OLAP Queries

Three analytical queries were developed for the OLAP data warehouse to provide comprehensive business intelligence insights.

* Sales Performance: Monthly sales trends and growth rates
* Category Analysis: Usage patterns by merchant category
* Customer Segmentation: User behavior and spending analysis

Reference: See screenshot "sql\_queries\_olap\_results.png" for query execution results.

# 6. Power BI Dashboard

An interactive Power BI dashboard was created to provide visual insights into the gift card system. The dashboard includes multiple visualizations and interactive filtering capabilities.

## 6.1 Dashboard Components

### Title and Slicers:

* Dashboard Title: "🎁 Gift Card Analytics Dashboard"
* Year Slicer: Filter data by year
* Merchant Category Slicer: Filter by merchant category

### KPI Cards:

* Total Sales: Revenue from gift card sales
* Total Usage: Amount spent using gift cards
* Active Cards: Number of active gift cards

### Visualizations:

* Clustered Column Chart: Sales vs Usage by Month
* Pie Chart: Usage by Category
* Table: Top Spenders

## 6.2 Interactive Features

* Cross-filtering between visualizations
* Dynamic filtering with slicers
* Responsive design for different screen sizes
* Professional color scheme and layout

Reference: See screenshot "powerbi\_dashboard.png" for complete dashboard view.

# 7. Implementation Details

## 7.1 Technology Stack

* Database: PostgreSQL 12+
* ETL: SQL scripts and Python
* Visualization: Power BI Desktop/Web
* Programming: Python 3.8+ with pandas, psycopg2, openpyxl
* Documentation: Markdown and Word documents

## 7.2 Project Structure

The project is organized into logical directories for easy navigation and maintenance:

* data/: Source CSV files (8 files with real data)
* sql/: SQL scripts for database creation, ETL, and queries
* scripts/: Python automation scripts
* documentation/: Screenshots, diagrams, and reports
* README.md: Comprehensive project documentation

# 8. Screenshots and Documentation

Comprehensive documentation has been created to support the project implementation and demonstrate compliance with course work requirements.

## 8.1 Screenshots

* all\_tables.png: Complete database structure visualization
* sql\_queries\_oltp\_results.png: OLTP query execution results
* sql\_queries\_olap\_results.png: OLAP query execution results
* powerbi\_dashboard.png: Power BI dashboard interface

## 8.2 Database Diagrams

* oltp.png: OLTP database schema diagram
* olap.png: OLAP data warehouse schema diagram

## 8.3 Technical Documentation

* README.md: Complete project overview and setup instructions
* SQL Scripts: Database creation, ETL, and query files
* Python Scripts: Data export and automation
* Power BI Files: Dashboard and data source files

# 9. Conclusion

This course work project successfully demonstrates the implementation of a complete data analytics solution for a gift card system. All requirements have been met and exceeded:

* ✅ OLTP database with 8 tables in 3NF normalization
* ✅ OLAP data warehouse with 9 tables in star schema
* ✅ SCD Type 2 implementation for historical tracking
* ✅ Bridge table for many-to-many relationships
* ✅ Comprehensive ETL process for data migration
* ✅ 3 OLTP queries for transactional analysis
* ✅ 3 OLAP queries for analytical insights
* ✅ Power BI dashboard with 6 visualizations and 2 slicers
* ✅ Complete documentation with screenshots and diagrams
* ✅ Professional project structure and implementation

The project showcases modern data architecture principles and provides a solid foundation for business intelligence and analytics applications. The combination of OLTP and OLAP systems, coupled with interactive visualizations, creates a comprehensive solution for gift card analytics.