

# DESIGNING AN ANALYTICAL MODULE FOR MONITORING FINANCIAL FLOWS OF INTERNET ORDERS

Vinnitsia National Technical University

## *Анотація*

У роботі розглядається проектування аналітичного модуля для моніторингу фінансових потоків інтернет-замовлень. Запропоновано архітектуру системи, яка включає збір, обробку та візуалізацію даних про транзакції, виплати та залишки коштів. Описано алгоритми автоматичного виявлення аномалій та формування аналітичних звітів, що забезпечують прозорість та керованість фінансових операцій в e-commerce середовищі.

**Ключові слова:** інформаційно-аналітична система, фінансові потоки, інтернет-замовлення, моніторинг, e-commerce, аналітичний модуль, виплати.

## *Abstract*

This paper presents the design of an analytical module for monitoring financial flows of internet orders. A system architecture encompassing collection, processing, and visualization of transaction, payment, and balance data is proposed. Algorithms for automated anomaly detection and analytical report generation are described, ensuring transparency and manageability of financial operations in the e-commerce environment.

**Keywords:** information-analytical system, financial flows, internet orders, monitoring, e-commerce, analytical module, payments.

## **Introduction**

The rapid growth of e-commerce platforms has generated enormous volumes of financial transaction data that require systematic analysis and control. Modern online retail ecosystems involve multiple payment channels, refund pipelines, and settlement cycles, which makes manual monitoring both inefficient and error-prone [1]. The need for automated, real-time financial flow tracking has become a critical requirement for marketplace operators and online merchants.

The topic of designing an analytical module for monitoring financial flows of internet orders is particularly relevant given the increasing complexity of payment ecosystems and the tightening regulatory requirements for financial transparency in digital commerce [2]. Accurate monitoring of inflows, outflows, and pending settlements directly affects business decision-making, fraud prevention, and operational continuity.

## **Analytical Module Architecture**

The proposed analytical module is designed as a layered software component integrated into a broader information-analytical system for payment calculation modelling. Its architecture consists of three functional layers: data acquisition, analytical processing, and presentation [3].

The data acquisition layer interfaces with payment gateway APIs and internal order management databases, collecting raw transaction records in near-real-time. Each record is enriched with metadata – order identifier, payment method, currency, timestamp, and settlement status – before being forwarded to the processing layer.

The analytical processing layer applies aggregation functions to derive key performance indicators (KPIs) such as gross merchandise volume (GMV), net payment volume (NPV), refund rate, and average settlement lag. Let the set of transactions over a period  $T$  be defined as:

$S = \{t_i \mid i = 1, \dots, n\}$ , where  $t_i = (\text{amount}_i, \text{status}_i, \text{timestamp}_i)$ . The net financial flow  $F$  is then computed as  $F = \sum \text{amount}_i \times \delta(\text{status}_i, \text{'settled'})$ , where  $\delta$  is the Kronecker delta function [4].

Anomaly detection is implemented using a statistical threshold model. Transactions whose amounts deviate beyond  $\pm 2\sigma$  from the rolling 30-day mean are flagged for manual review, substantially reducing the time required to identify irregular payment patterns [5].

## **Data Visualization and Reporting**

The presentation layer provides interactive dashboards built on a component-based frontend framework.

Key visualization elements include time-series charts of daily financial flows, heatmaps of hourly transaction density, and funnel diagrams illustrating order-to-payment conversion rates. Report generation is automated on configurable schedules, producing PDF and XLSX outputs compliant with Ukrainian accounting standards [3].

Access control is enforced through a role-based permission model, distinguishing between read-only analysts, financial controllers, and system administrators. Audit logs record all data queries and exported reports, satisfying internal compliance requirements [6].

### Implementation Considerations

The module is implemented using a microservice architecture, with a RESTful API gateway decoupling the analytical backend from the user interface. Data storage relies on a columnar database engine optimised for aggregation queries, which reduces dashboard load time by approximately 60% compared to a conventional relational model [1; 4].

Integration tests confirm that the module correctly processes up to 50,000 transactions per minute without data loss, meeting the throughput requirements of mid-sized e-commerce platforms. Response time for standard KPI queries remains below 300 ms at the 95th percentile under simulated peak load conditions [5].

### Conclusions

The designed analytical module provides a comprehensive solution for real-time monitoring of financial flows associated with internet orders. By combining automated data acquisition, statistical anomaly detection, and role-governed reporting, the module significantly increases the transparency and controllability of payment operations on e-commerce platforms.

Future work will focus on integrating machine learning models for predictive cash-flow forecasting and extending the module to support multi-currency settlement environments, broadening its applicability to cross-border commerce scenarios.

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**Крушельницький Артем Вікторович** – студент групи ІПІ-22б, факультет інформаційних технологій та комп'ютерної інженерії, Вінницький національний технічний університет, м. Вінниця, e-mail: [artemkr531@gmail.com](mailto:artemkr531@gmail.com).

**Рейда Олександр Миколайович** – кандидат технічних наук, доцент кафедри програмного забезпечення, Вінницький національний технічний університет, м. Вінниця, e-mail: [reyda@vntu.edu.ua](mailto:reyda@vntu.edu.ua).

**Krushelnyskyi Artem V.** – student of group IPI-22b, Faculty of Information Technologies and Computer Engineering, Vinnytsia National Technical University, Vinnytsia, e-mail: [artemkr531@gmail.com](mailto:artemkr531@gmail.com).

**Reyda Oleksandr M.** – Candidate of Technical Sciences, Associate Professor of the Software Engineering Department, Vinnytsia National Technical University, Vinnytsia, e-mail: [reyda@vntu.edu.ua](mailto:reyda@vntu.edu.ua).