Technical Guide for VAT Input Credit Token (VICT) System

(Patent Pending: Application filed with the Intellectual Property Rights Institution, Sri Lanka, on 28th April 2025)

Introduction to VICT

The VAT Input Credit Token (VICT) system represents a transformative approach to VAT management, leveraging blockchain technology and digital tokens to efficiently handle input tax credits without cash refunds. The patented concept addresses current administrative complexities, reduces opportunities for fraud, and enhances the accuracy and transparency of VAT transactions.

Technical Overview

VICT is based on a blockchain-enabled token mechanism designed to replace traditional paper vouchers and electronic voucher systems like Sri Lanka's now-defunct Simplified VAT (SVAT) scheme.

Core Technical Components:

- **General Liability Token (GLT)**
  GLT is an abstract, blockchain-based digital token class that serves as the foundational structure for VICT. GLTs are mutable (adjustable), divisible (can be split), and aggregable (combinable), thus enabling precise and flexible handling of tax liabilities across multiple transactions.
- **Unspendable Statistical Token (UST)**
  Complementing GLTs, USTs are non-transferable tokens used strictly for statistical tracking, compliance monitoring, and real-time anomaly detection within each taxpayer's digital wallet.

System Architecture

The system architecture consists of several integrated layers:

1. Token Management Layer

- **Smart Contracts:** Ensure secure issuance, validation, transfer, and reconciliation of VICT.
- **Digital Wallets:** Manage VICT balances, transaction histories, and token lifecycle operations (aggregation, subdivision, expiry).

2. Compliance Monitoring Layer

- **Rule-Based Logic:** Applies regulatory-defined thresholds, validity periods, and transaction-specific rules.
- **AI-Based Anomaly Detection:** Continuously analyzes transaction patterns and flags suspicious activities, such as circular trading or transaction structuring.

3. Blockchain Ledger Layer

- All transactions involving VICT tokens are immutably recorded on a blockchain, creating a transparent, auditable ledger.

(Refer Graph: "Overall GLT UST VICT GTT System Architecture")

Workflow Process for VICT

The operational workflow involves several clearly defined processes:

Step 1: Token Issuance

- The Revenue Authority (RA) issues VICTs directly to verified taxpayers based on VAT-related qualifying activities.

Step 2: Transaction Execution

- During business-to-business (B2B) transactions, the buyer requests a VICT token from the seller alongside invoices.
- The VICT token, upon validation, is issued and transferred to the buyer’s digital wallet.

Step 3: Validation & Reconciliation

- Smart contracts validate each token transaction based on authenticity of invoices, supplier credentials, and other predefined criteria.
- Periodic reconciliation occurs automatically through blockchain records to ensure compliance and eliminate discrepancies.

Step 4: Real-time Statistical and Compliance Monitoring

- Each transaction updates the UST associated with the digital wallets, recalculating statistical metrics such as mean, variance, transaction frequency, and entropy.
- AI-powered analytics continuously evaluate transaction flows and highlight any irregularities.

Step 5: Anomaly Handling

- Suspicious patterns trigger red flags within the UST system, initiating automatic wallet freezes, token audits, or manual reviews.

(Refer Graph: "VICT Workflow and Anomaly Detection Diagram")

Technical Advantages of the VICT System

Enhanced Flexibility:

- Tokens can be dynamically subdivided or aggregated, enabling precise offsetting of VAT liabilities across multiple transactions without manual reconciliation.

Reduction of Administrative Burden:

- Automates compliance verification, reducing manual intervention and speeding up processes.

Fraud Mitigation:

- Real-time transaction monitoring through AI ensures rapid detection and prevention of fraudulent behaviors such as circular trading and credit misappropriation.

Transparency and Auditability:

- Blockchain provides an immutable ledger of all transactions, ensuring traceability and transparency across the supply chain.

Use Case Examples

Example 1: Standard VAT Input Credit Scenario

- A registered importer receives VICT from the RA against verified imports.
- These tokens are subsequently used to offset VAT liabilities on domestic B2B sales, eliminating cash transactions and manual reconciliation.

Example 2: Automated Missing Trader Resolution

- If a trader becomes inactive or "missing," the system automatically redistributes outstanding VAT liabilities proportionally among previous legitimate token holders, ensuring fairness and minimizing disruption.

(Refer Graph: "VICT Missing Trader Automated Resolution Flow")

Statistical and Compliance Attributes (UST)

UST continuously tracks and evaluates critical metrics for each wallet:

- **Transaction Count**
- **Mean Transaction Value**
- **Variance**
- **Entropy (unpredictability measure)**
- **Coefficient of Variation**
- **Special Statistical Metrics** (activated in anomalies like abnormal transaction spikes)

(Refer Graph: "UST Statistical Data Management Flow")

Technical Specifications (JSON Data Structures)

For precise software integration, the following JSON data structures represent typical VICT transactions:

```
{
  "transaction_id": "VICT-TXN-0001",
  "timestamp": "2025-07-21T12:30:00Z",
  "sender_wallet": "WALLET-IMPORTERA",
  "receiver_wallet": "WALLET-DISTRIBUTORB",
  "token": {
    "value": -155000.00,
    "vat_rate": 0.15,
    "goods": "auto_parts",
    "expiry_days": 90
  },
  "status": "awaiting_verification",
  "signatures": {
    "wallet_owner": "SIG_IMPORTERA",
    "issuer": null
  }
}
```

Regulatory and Policy Alignment

VICT operations strictly comply with current tax regulations and policies:

- VAT Registration Policies
- KYC and AML compliance for wallet registrations
- VAT Suspension Rules
- Token Transfer Legal Clauses
- Fraud Detection Policies

Future Extensions and Scalability

The VICT system is designed for easy scalability and integration into broader tax frameworks. Potential future enhancements include:

- Federated AI Models for cross-border compliance.
- Extended applications for broader indirect taxation mechanisms.

Conclusion

The VICT system significantly modernizes VAT management, delivering efficiency, transparency, flexibility, and security. Its implementation promises reduced fraud, lower administrative burdens, and streamlined compliance, representing a crucial step forward in digital taxation technology.

Appendices (for Reference)

- **Appendix A:** AI Anomaly Detection Methodologies
- **Appendix B:** Detailed Statistical Attributes for UST
- **Appendix C:** JSON Transaction Examples
- **Appendix D:** Compliance and Regulatory Terms Glossary
- **Appendix E:** Technical Integration Guidelines

(Graphs and diagrams such as "VICT_Use_Case Diagram", "VICT_Sequence_Diagram", "VICT_Process_Flow Diagram", "AI Compliance System Diagram" should be integrated here later.)

Appendix A: AI Anomaly Detection Methodologies

A.1 Overview

The VICT system uses an AI-enhanced compliance module layered over the UST framework. This module identifies patterns of fraud or non-compliance that would be difficult to catch using static rule sets alone.

A.2 Detection Techniques

- **Unsupervised Learning (e.g., Clustering)**: Groups wallets with similar behavioral traits; deviations flag outliers.
- **Time-Series Analysis (e.g., ARIMA, LSTM)**: Detects abnormal bursts or suppression in token activity over time.
- **Graph-Based Analytics**: Models wallet networks to detect circular trading and entity collusion.
- **Narrative-based LLM Analysis** *(Future Integration)*: Describes suspicious transaction cycles with natural language summaries.

A.3 Workflow Summary

1. **Data Ingestion**: UST statistics stream into the AI engine.
2. **Risk Scoring**: Each anomaly is assigned a confidence score (e.g., 0.0–1.0).
3. **Flagging**: High-confidence scores (>0.80) result in red flag logging, wallet freezing, or manual escalation.
4. **Model Feedback**: Resolved flags improve AI models via reinforcement.

A.4 Examples of Red Flags

- Circular Token Paths
- Token “Structuring” (breaking into audit-threshold pieces)
- Frequent large-value transfers to low-risk wallets
- Dormant wallet sudden activity spikes

Appendix B: Detailed Statistical Attributes for UST

B.1 General Statistics Stored in Each Wallet's UST:

Metric	Description
Transaction Count	Total number of token transfers
Mean	Average value of transactions
Variance	Spread of transaction values
Entropy	Predictability measure of wallet behavior
Skewness	Directional bias (asymmetry) in token flow
Coefficient of Variation	Standard deviation as a % of the mean
Drawdown	Largest decline in token flow over time
Value at Risk	Estimated loss threshold under confidence level

B.2 Special Statistics

Activated during outlier detection (e.g., a surge 3σ above the mean):

- **Surge Start Date**
- **Duration of anomaly**
- **Transaction values flagged**
- **Confidence Score**
- **Anomaly Cause** (e.g., "Circular Flow", "Structuring", etc.)

B.3 Promotion & Recalibration

- Special stats evolve into new general stats if persistent.
- Tokens may be burned, merged, or credited based on cumulative behavior.

Appendix C: JSON Transaction Examples

C.1 VICT Token Transfer Sample


```
{
  "batch_id": "VICT-BATCH-2025-07-21",
  "submitted_by": "ImporterA",
  "transactions": [
    {
      "sub_txn_id": "VICT-TXN-0001",
      "sender": "WALLET-IMPORTERA",
      "receiver": "WALLET-DISTRIBUTORB",
      "value": -155000.00,
      "vat_rate": 0.15,
      "goods": "auto_parts",
      "gross_profit_ratio": 0.22,
      "token_expiry_days": 90,
      "transfer_time": "2025-07-21T12:30:00Z"
    }
  ],
  "ust_batch_summary": {
    "transaction_count": 154,
    "coefficient_of_variation": 0.21,
    "skewness": 0.92
  },
  "status": "awaiting_verification",
  "signatures": {
    "wallet_owner": "SIG_ImporterA_xyz987",
    "issuer": null
  }
}
```

Appendix D: Compliance and Regulatory Terms Glossary

Term	Definition
GLT	General Liability Token – foundational token class for liability recording
VICT	Token variant used for managing VAT Input Credits
UST	Unspendable Statistical Token for behavioral monitoring
Red Flag	AI-logged anomaly in transaction behavior
Circular Trading	Fraudulent token flow in loops among coordinated entities
Smart Contract Wallet	Wallet governed by blockchain rules for transaction validity
Dormant Token Purging	Automatic burn of unused tokens
Token Aggregation	Merging multiple tokens into a single transferable unit
Reconciliation	Automated balancing of tokens and invoices

Appendix E: Technical Integration Guidelines

E.1 Integration Touchpoints

- **ERP System Connectors**: Token issuance, transfers, and reconciliation APIs.
- **Blockchain Nodes**: Each institution may host its node or use a permissioned layer.
- **AI Engine API**: Configurable thresholds and behavior profiles for industry-specific needs.

E.2 Data Security Requirements

- End-to-end encryption (AES-256 minimum)
- Digital signatures on all transactions
- On-chain hash verification

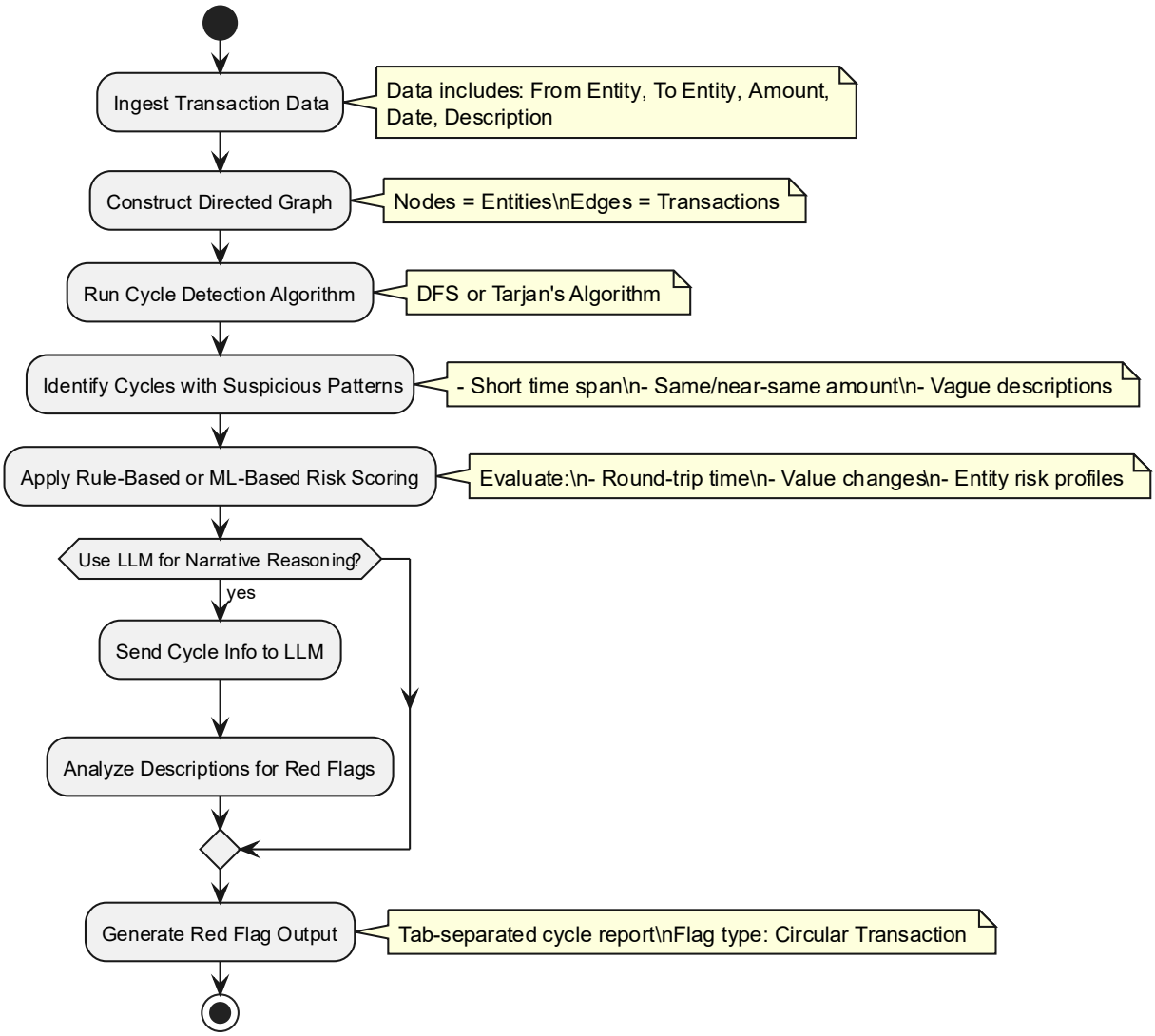
E.3 Deployment Models

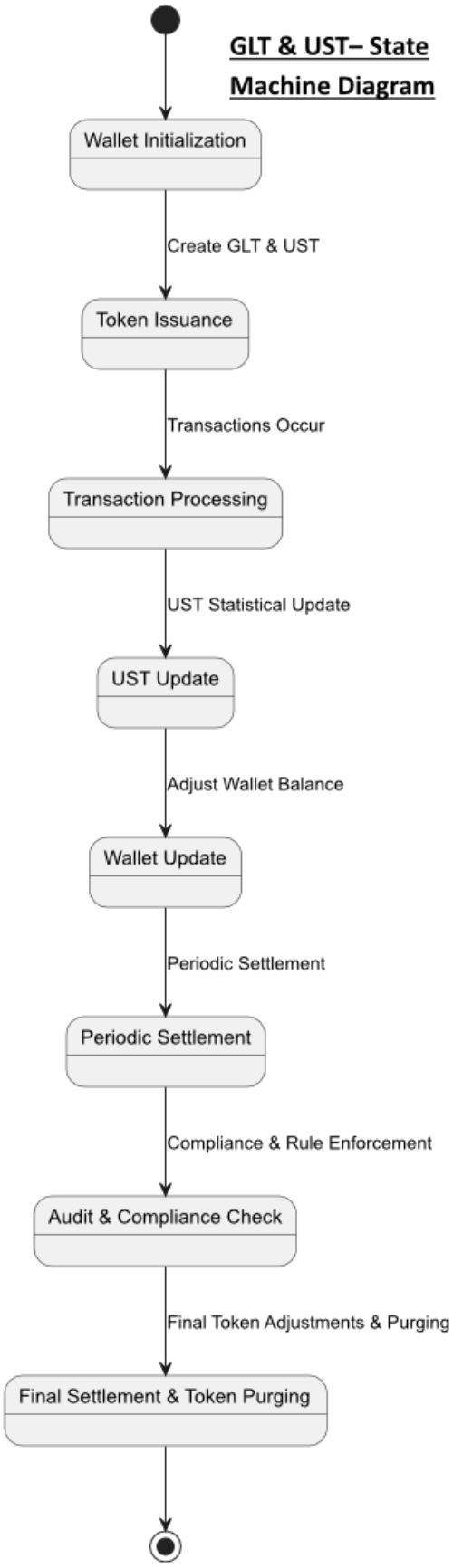
- **Cloud-Based (SaaS)**: Minimal government hardware cost
- **On-Premise (Hybrid)**: For countries with national data sovereignty concerns
- **Federated Ledger Option**: Cross-border integration among tax authorities

E.4 Wallet Maintenance

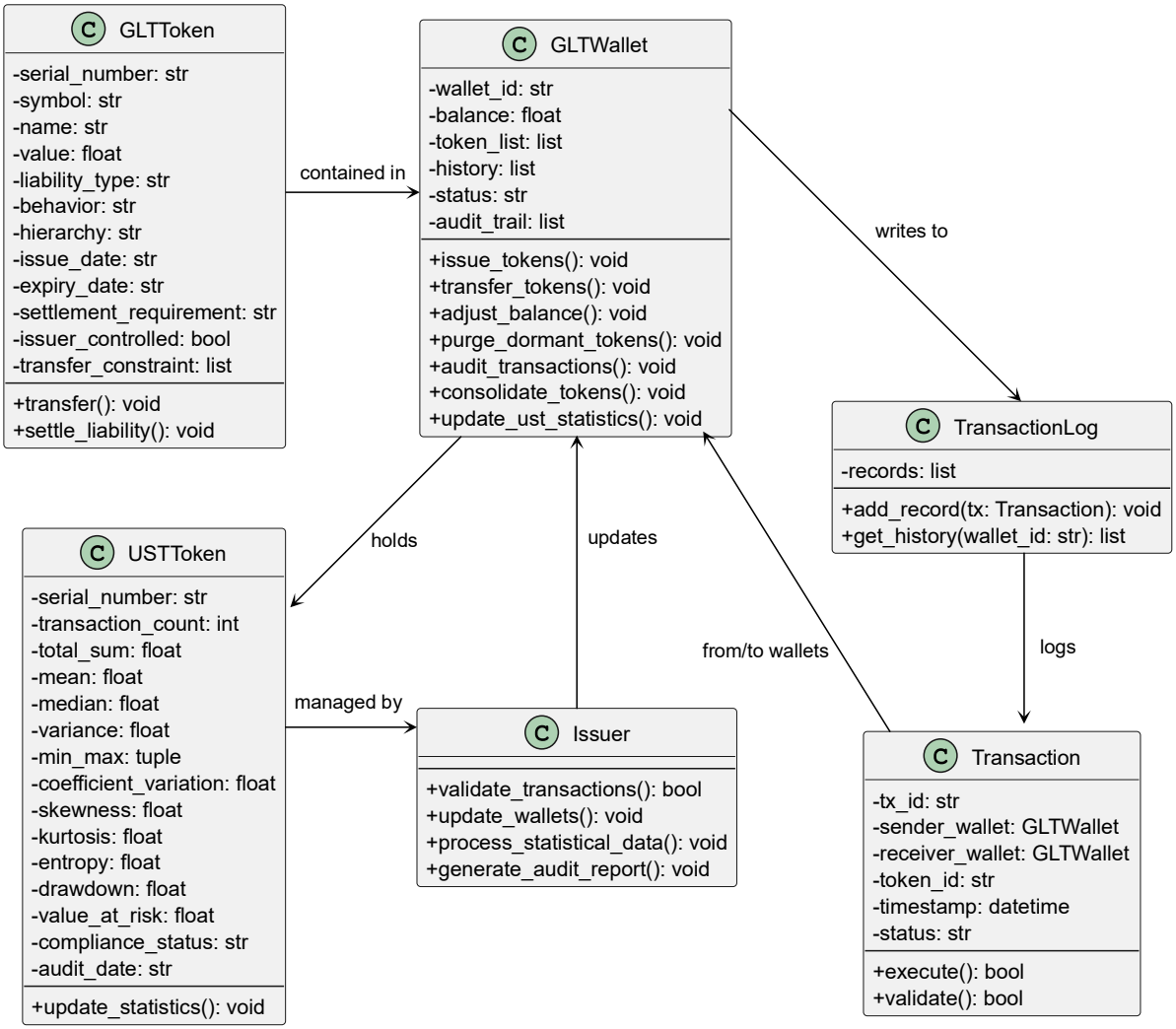
- Token lifecycles automatically managed via UST statistics
- Token expiration, renewal, and burning rules encoded in smart contracts
- Wallets may be frozen under AI-flagged non-compliance

AI Module for Circular Transaction Red Flag Detection

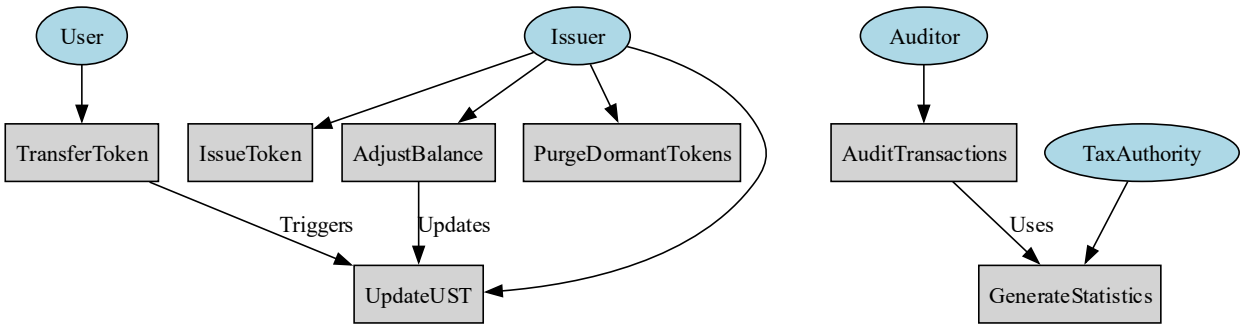


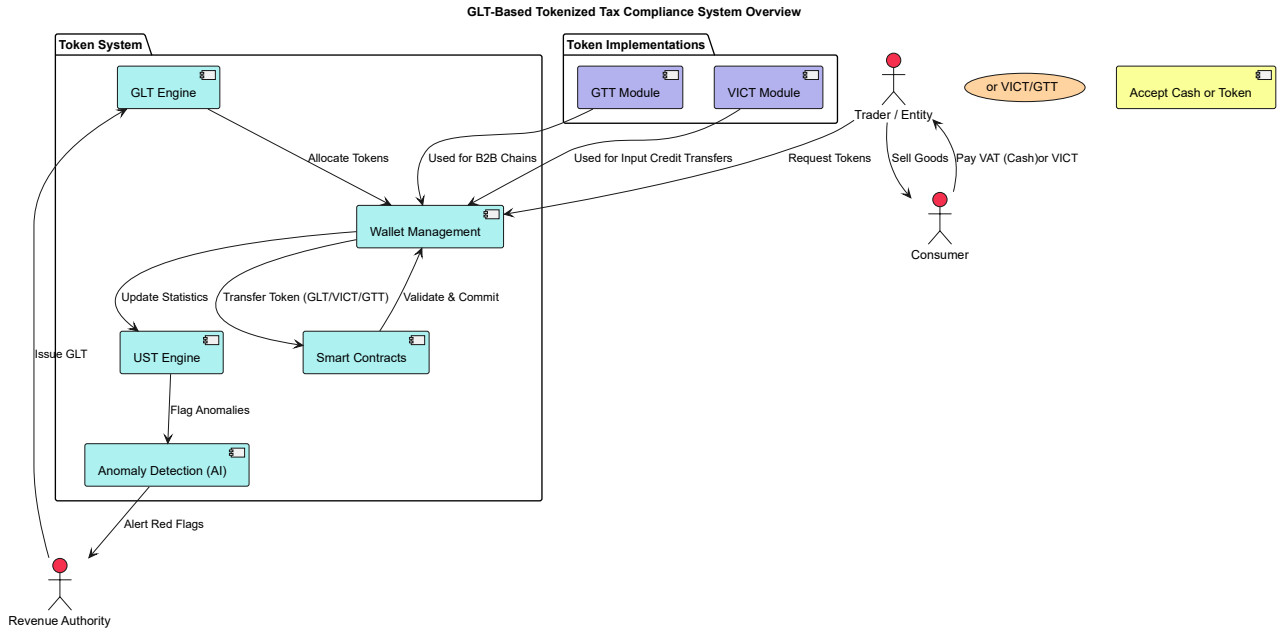

GLT & UST– State Machine Diagram
Wallet Initialization
Create GLT & UST
Token Issuance
Transactions Occur
Transaction Processing
UST Statistical Update
UST Update
Adjust Wallet Balance
Wallet Update
Periodic Settlement
Periodic Settlement
Compliance & Rule Enforcement
Audit & Compliance Check
Final Token Adjustments & Purging
Final Settlement & Token Purging

GLT and UST Class Diagram

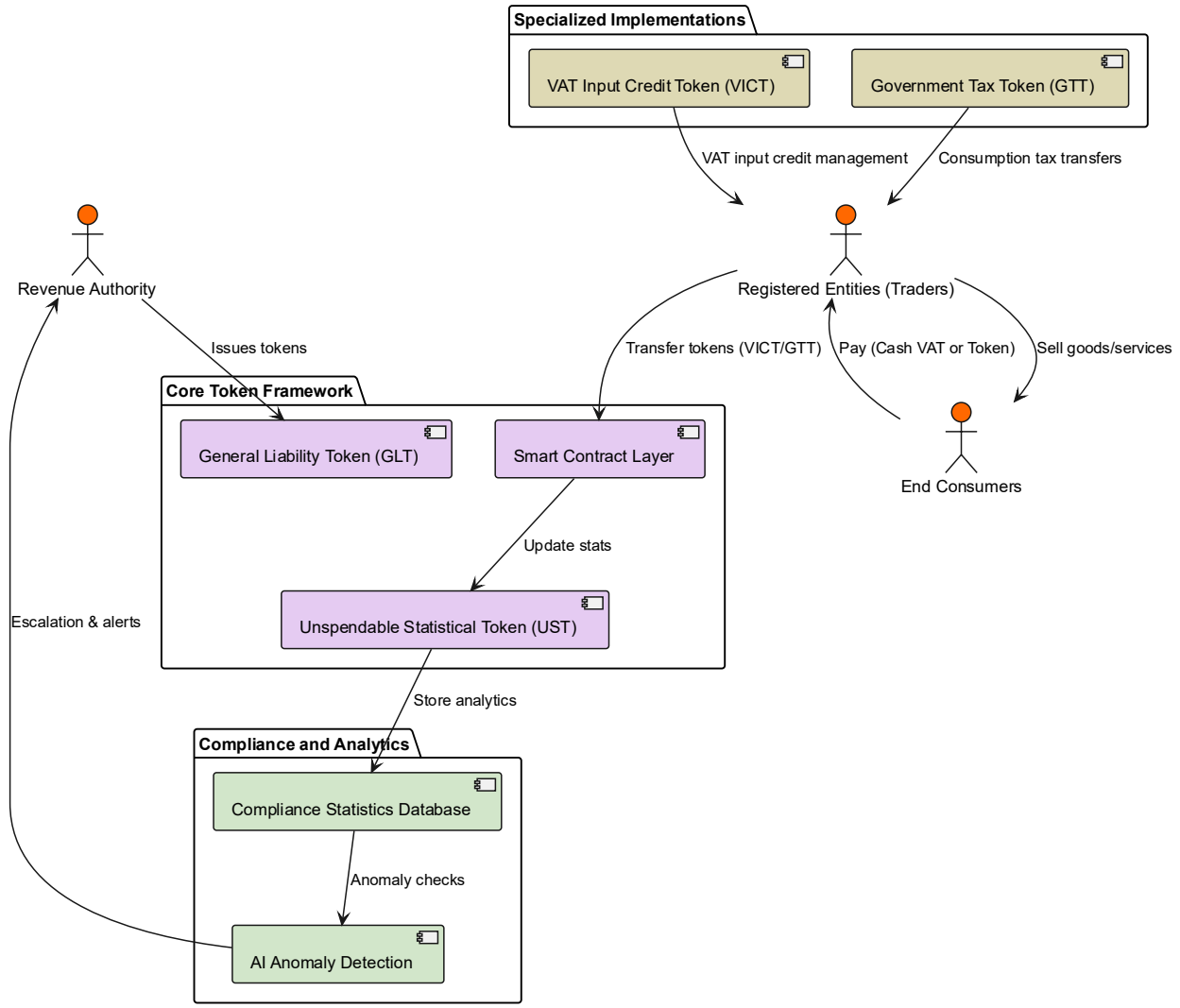


GLT usecase

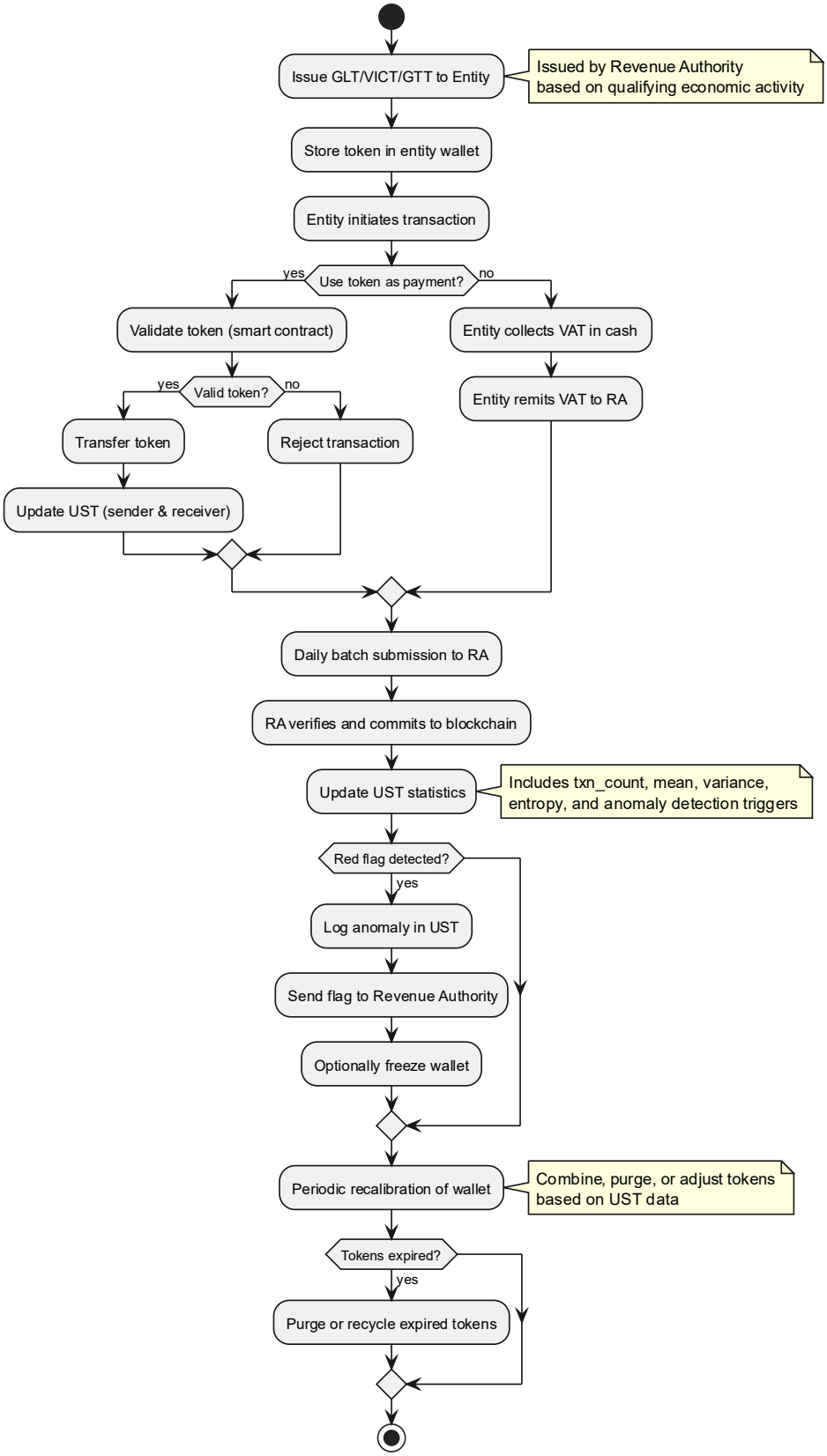


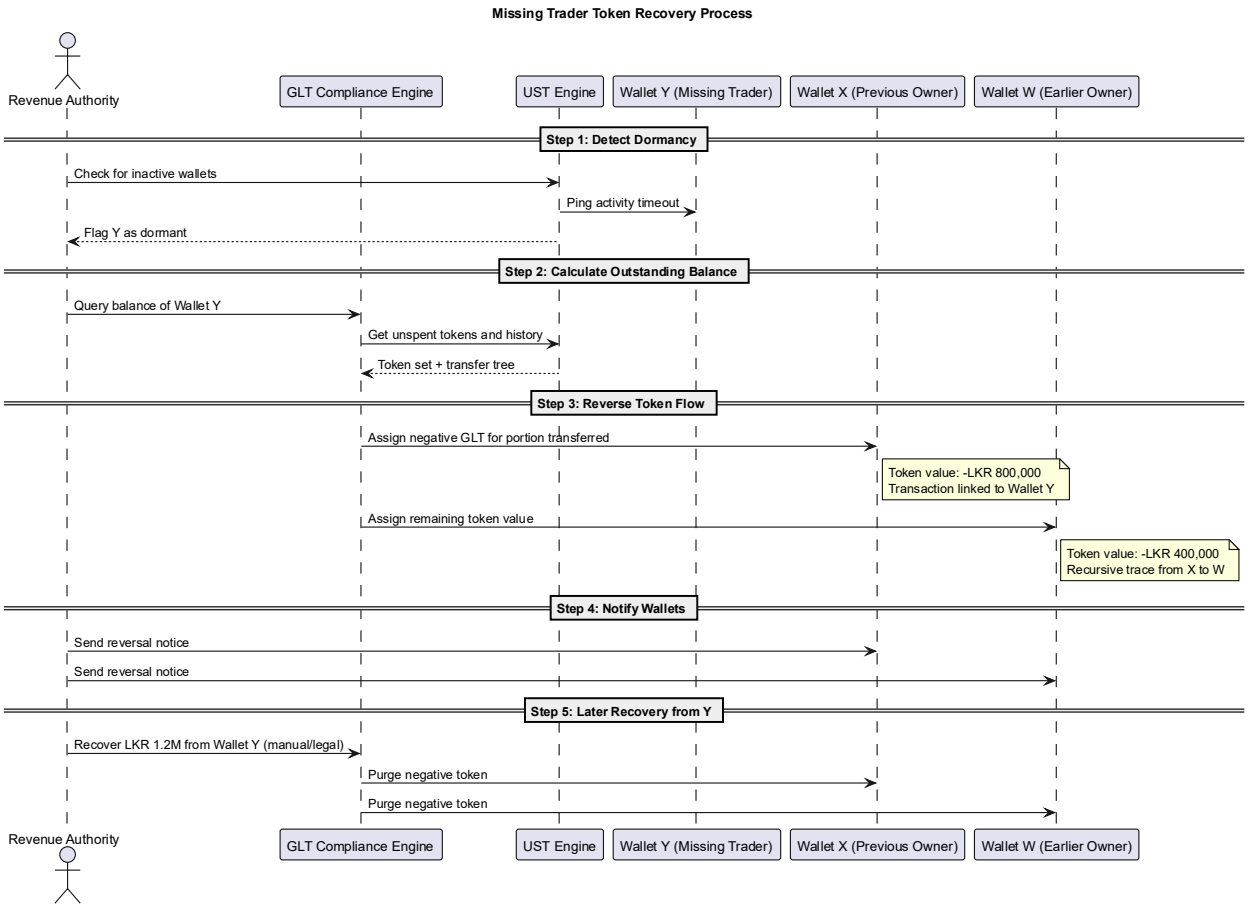

GLT-Based Tokenized Tax Compliance System Overview
Token System
GLT Engine
Wallet Management
UST Engine
Smart Contracts
Anomaly Detection (AI)
Token Implementations
GTT Module
VICT Module
Trader / Entity
or VICT/GTT
Accept Cash or Token
Consumer
Revenue Authority
Allocate Tokens
Used for B2B Chains
Used for Input Credit Transfers
Request Tokens
Sell Goods
Pay VAT (Cash)or VICT
Update Statistics
Transfer Token (GLT/VICT/GTT)
Validate & Commit
Issue GLT
Flag Anomalies
Alert Red Flags

Overall GLT UST VICT GTT System Architecture

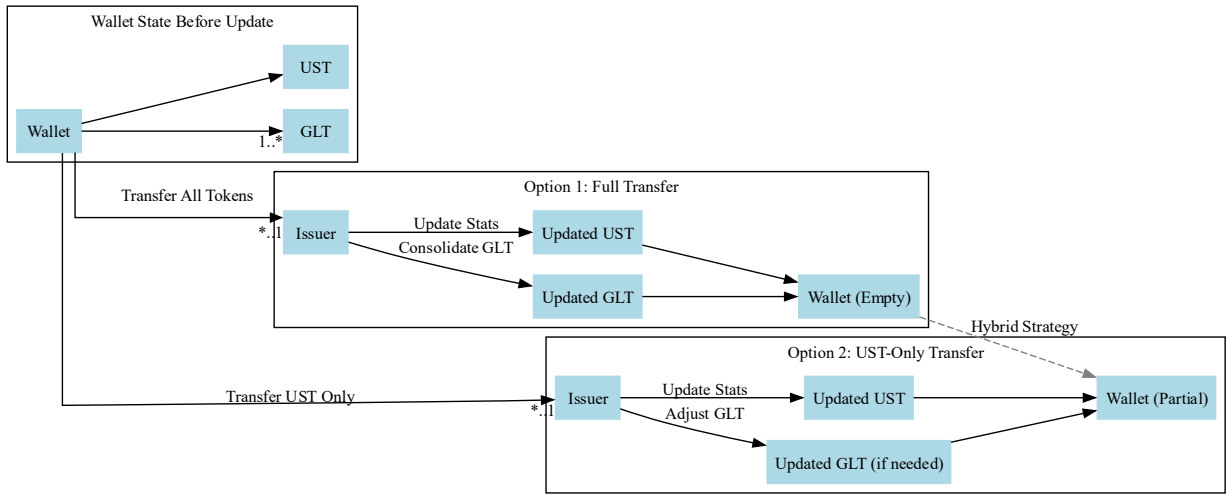


GLT & UST Tokenized Tax System: End-to-End Workflow

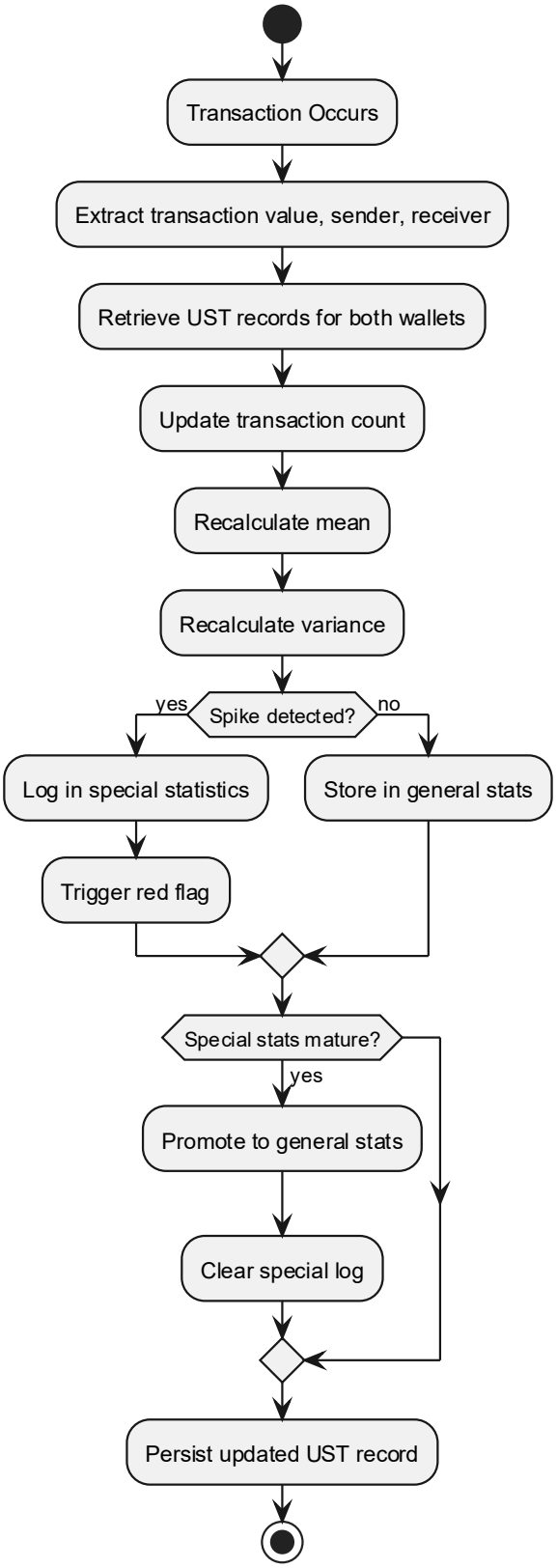




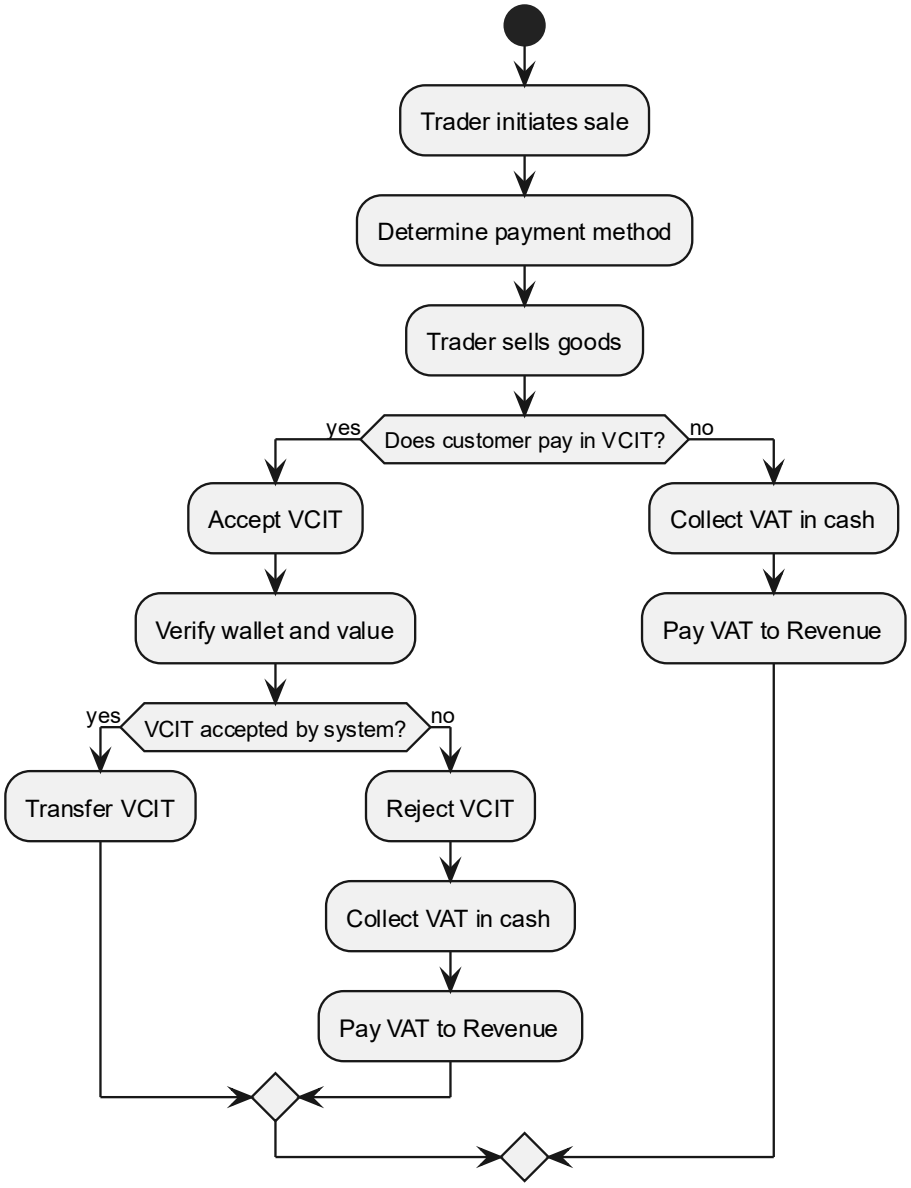
Perodic Wallet Update



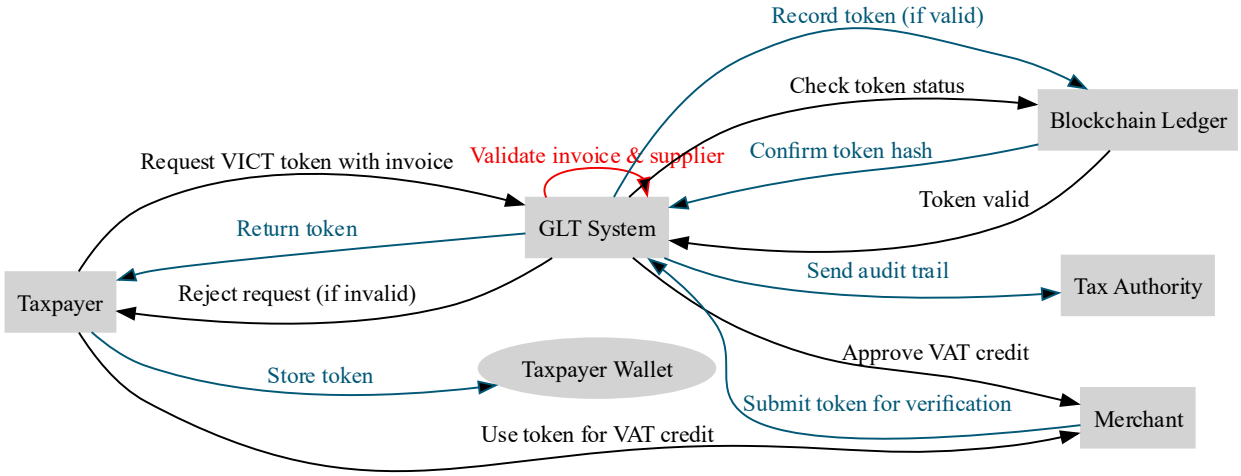
UST Statistical Data Management Workflow



VICT_Activity_Diagram



VICT_Process_Flow



VICT_Use_Case