SIRIM STANDARD

SIRIM xx:2026

ICS: 35.080

Supply Chain Traceability Platform - Framework and Requirements

SIRIM Berhad

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Contents

Page

Foreword ii

0 Introduction 1

1 Scope 2

2 Normative references 2

3 Terms and definitions 2

4 General requirements 4

5 Principles 5

6 Framework 5

7 Design architectures 7

8 Functional modules 9

9 Application programming interface 10

10 Industry application/use case 11

Annex A Sector example - Urban farming traceability 15

Annex B Sector example - Transportation traceability 25

Foreword

The development of this SIRIM Standard was funded by Intelligence Traceability Sdn Bhd.

This standard was developed by the Project Committee on Supply Chain Traceability Systems established by SIRIM Berhad.

This standard was developed with the objectives as follows:

a) to assist organisations and industries in the design and implementation of traceability systems in the operations and supply chain of their organisation;

b) to provide guidelines for organisations in the implementation of traceability platform towards becoming more efficient market-responsive value chain and customer-focused organisations;

c) to establish a unified industrial benchmark that ensures end-to-end visibility, data integrity, and cross-border interoperability across supply chains.

d) to serve as a baseline guideline applicable to multiple industries and product categories, with provisions for developing sub-sections or industry-specific annexes (e.g., for food, cosmetics, pharmaceuticals, logistics, etc.) at a later stage.

This standard will be reviewed periodically and, if necessary, revised to reflect current needs and conditions. Users and other interested parties may submit comments on the contents of this standard for consideration in future versions.

Information to assist users of the standard

For the purposes of this standard, the following International Organization for Standardization (ISO) definitions have been adopted regarding verbal forms for the expression of provisions:

a) "**shall**" indicates an auditable **requirement**: it is used to indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted;

b) "**should**" indicates a **recommendation**: it is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited;

c) "**may**" indicates a **permission**: it is used to indicate a course of action permissible within the limits of the document; and

d) "**can**" indicates a **possibility** or a **capability**: it is used for statements of possibility and capability, whether material, physical or causal.

Compliance with this standard does not by itself grant immunity from legal obligations.

Supply Chain Traceability Platform - Framework and Requirements

0. Introduction

0.1 A traceability system is a communication tool to assist an organisation operating within the supply chain to achieve defined objectives in a management system. The choice of a traceability system is influenced by regulations, product characteristics, customer and market expectations. The complexity of the traceability system can vary depending on the features of the product and the objectives to be achieved and is applicable when necessary to determine the history or location of a product or its relevant components. The traceability solutions identify, capture, track and trace events along the supply chain, to provide transparency and insights into the sources, production, manufacturing, movement, and consumption of products and resources.

0.2 Traceability platform is a digital system that enables the end-to-end tracking, recording, and verification of products across the entire supply chain, from origin to final consumption. It captures key data at each stage of raw material acquisition, production, processing, logistics, and distribution, creating a transparent and auditable record that can be accessed by relevant stakeholders.

0.3 Traceability provides significant values/benefits to the organisations by:

a) Enhancing compliance with regulations

Traceability systems support adherence to regulations, for example food safety regulations by enabling precise tracking of ingredients and products throughout the supply chain.

b) Improving inventory management

Facilitate real-time monitoring and control of inventory levels, reducing waste and optimising stock availability.

c) Increasing supply chain transparency

By providing end-to-end visibility, traceability systems help build trust among stakeholders and consumers through transparent sourcing and production practices.

d) Optimising production processes

Detailed tracking allows for better control over production stages, leading to improved efficiency, reduced errors, and higher product quality.

e) Predicting and mitigating risks

Traceability enables early identification of potential disruptions/risks or threats, allowing companies to respond proactively and maintain business continuity.

f) Understanding customer preferences

Data collected through traceability systems can offer insights into consumer behaviour, helping businesses tailor products and services to meet market demands.

0.4 The framework for this standard is aligned with the globally recognised frameworks such as GS1 GTS, GS1 EPCIS and ISO 22005.

1. Scope

This standard provides principles, framework and requirements for designing and implementing interoperable traceability platform.

It can be applied to various sectors (e.g., food, pharmaceuticals, consumer products, logistics, etc.), enabling organisations to identify and capture track and trace events along the supply chain by providing transparency and insights into the sources, production and logistics.

This standard provides guidelines for organisations in the implementation of traceability platform towards strengthening supply chain sustainability through the adoption of digital traceability.

It also provides examples that demonstrate the application and implementation of traceability systems interacting with traceability platform based on the sectors, product categories, regions and application areas.

2. Normative references

The following normative references are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the normative reference (including any amendments) applies.

GS1 *Global Traceability Standard* (GSI GTS)

GS1 *Electronic Product Code Information Services* (GS1 EPCIS)

ISO 22005, *Traceability in the feed and food chain - General principles and basic requirements for system design and implementation*

3. Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1 Application Programming Interface (API)

boundary across which a software application uses facilities of programming languages to invoke software services.

3.2 blockchain

distributed ledger with confirmed blocks organised in an append-only, sequential chain using hash links.

3.3 Critical Tracking Events (CTEs)

actual events that occur to the traceable objects during their lifecycle, including but not limited to receiving, transforming, packing, shipping and transporting.

3.4 end-to-end traceability

ability to track and trace an object through its entire life cycle and through all parties involved in its production, custody, trade, transformation, use, maintenance, recycling or destruction.

3.5 EPCIS (Electronic Product Code Information Services)

GS1's data sharing standard for enabling visibility, within organisations as well as across an entire supply chain of trading partners and other stakeholders.

NOTE. This document helps provide the “what, when, where, why and how” of products and other assets, enabling the capture and sharing of interoperable information about status, location, movement and chain of custody.

3.6 interoperability

ability of two or more systems or applications to exchange information and to mutually use the information that has been exchanged.

3.7 JSON (JavaScript Object Notation)

lightweight data-interchange format that is easy for humans to read and write, and easy for machines to parse and generate.

3.8 Key Data Elements (KDEs)

pieces of data that describe the actual instances of the CTEs. The data will commonly cover the five dimensions (Who, What, Where, When, Why).

3.9 product recall

removal of product(s) from the market at any stage of the product chain, including that possessed by consumers.

3.10 RESTful API (Representational State Transfer)

architectural style for designing networked applications. It allows different systems to communicate over HTTP by using standard HTTP methods (GET, POST, PUT, DELETE, etc.).

3.11 supply chain

those involved, through upstream and downstream linkages, in activities delivering value in the form of a product to different interested parties.

3.12 traceability

ability to trace the history, application or location of an object.

3.13 traceability system

set of methods, procedures and routines used by an individual party to manage traceability in its supply chains.

NOTE. Traceability systems are used by individual parties to increase visibility across their own organisation and then share that visibility data with upstream and downstream parties to contribute to end-to-end supply chain traceability.

3.14 traceability platform

digital system that enables the end-to-end tracking, recording, and verification of products across the entire supply chain, from origin to final consumption. It captures key data at each stage of raw material acquisition, production, processing, logistics, and distribution, creating a transparent and auditable record that can be accessed by relevant stakeholders.

4. General requirements

4.1 When considering a product or a service, traceability can relate to:

a) origin of materials and parts;

b) processing history; and

c) distribution and location of the product or service after delivery.

4.2 The traceability systems shall, to the extent possible, capture the data at every node or checkpoint which begins with the suppliers of raw materials, ingredients and components (i.e. upstream processes) and end with the wholesalers, agents, distributors, retailers and customers (i.e. downstream processes).

4.3 The product in the supply chain shall comply with all acts and regulations that are applicable to the product in Malaysia and, if applicable, in the country to which the product is exported to.

4.4 The traceability systems can facilitate the nonconformity of the product including the withdrawal and/or recall of the product.

4.5 For traceability platform to work properly, each individual organisation will need to ensure that data sharing is available by allowing interoperability with systems of other organisations across their supply chains via APIs, GS1, GS1 EPCIS or blockchain.

5. Principles

5.1 The principles of traceability systems should be as follows:

a) compliant to any relevant regulations or policies;

b) compliant with defined requirements or product characteristics;

c) verifiable;

d) applied consistently and equitably;

e) results oriented;

f) cost effective;

g) practical;

h) transparent; and

i) integrity.

5.2 The objectives of the traceability platform should take into consideration the principles as identified in 5.1. The objectives of traceability platforms are as follows but not limited to:

a) fulfil relevant national or international regulations;

b) meet product/process specifications/requirements;

c) determine the end-to-end product visibility;

d) enable the communication amongst the stakeholders throughout the supply chain;

e) act as intermediary for communicating with other regional and other country platforms; and

f) provide unified data model for industry adoption.

6. Framework

6.1 General

The organisation should identify which steps in its business processes that are important from a traceability perspective. Subsequently, the organisation will need to establish processes to define and capture all of the relevant data about these business process steps, which will enable the effective use of the data within and outside of the organisation.

A unified data model is critical for implementations of data capture solutions i.e. CTE and KDE.

6.1.1 GS1 identification systems are foundational to building traceability in supply chain systems, enabling visibility, interoperability, and accountability across industries. Once organisations start using a unified data model to identify and capture product data, the information can be shared in a standardised format, ensuring data completeness and accuracy.

6.1.2 GS1 system of identification keys, include the following but not limited to:

a) GTIN (Global Trade Item Number) for product item;

b) GLN (Global Location Number) for location such as geographic coordinates as well as trading partners;

c) SSCC (Serial Shipping Container Code) for logistic units;

d) EPC Class (Electronic Product Code) for objects in the supply chain;

e) Unique identifier (UID)/Serial Numbers for item-level traceability;

f) GRAI (Global Returnable Asset Identifier) for returnable assets, e.g., pallets, crates, etc;

g) GIAI (Global Individual Asset Identifier) for fixed assets, e.g. vehicles;

h) GDTI (Global Document Type Identifier) for document items, e.g., invoices, tax forms, certificates, etc;

i) GSIN (Global Shipment Identification Number) for grouping of logistic units that need to be delivered together. Typically used by shippers to instruct transport providers or freight forwarders;

j) GINC (Global Identification Number for Consignment) for grouping of logistic units (that may belong to different shipments) that need to be transported together, e.g., a Master Airway Bill (MAWB) or a Master Bill of Lading (MBL); and

k) GSRN (Global Service Relation Number) for service relationships (provider as well as recipient).

6.2 Event reporting based on EPCIS standard

6.2.1 The traceability platform shall use EPCIS for event capture and data exchange.

NOTE. Recommended version is EPCIS 2.0, as it supports JSON/RESTful APIs and modern data sharing models suitable for cloud and blockchain integration.

6.2.2 Traceability data is generated through execution of a variety of business processes carried out by each organisation**.** This data provides business content to applications that use the data.

Each traceability data should cover the 5W1H attributes:

a) **What:** Unique identification information of what trade items and/or shipping containers were involved (product identifier GTIN);

b) **When:** The date and time when receiving occurred, and the local time zone in effect (timestamp of event);

c) **Where:** Location where the shipment was received, and where the items are expected to be following the event (GLN or geographic coordinates);

d) **Why**: Information about the business context (business step or reason);

e) **Who:** Entities involved in the handling, custody or ownership of the objects moving through the supply chain (party responsible); and

f) **How:** (optional): Sensor-based conditional information captured (method or process, e.g., transportation, processing, repackaging).

6.2.3 End-to-end traceability extends the responsibilities of the organisation to encompass the exchange of unified data with other stakeholders along the supply chain.

Each member of the supply chain should, at a minimum, be able to trace back to the direct suppliers of traceable objects and to track forward to the direct recipients of traceable objects (it can be extended to end-consumers, where necessary).

This enables the possibility for all parties to gain access to relevant data further upstream and downstream through queries of direct trading partners (often referred to as a “one-up, one-down” approach).

7. Design architectures

7.1 UID Issuing Functionality

7.1.1 The traceability platform shall serve as a central entity for issuing, distribution and managing UID. This includes:

a) UID generation

   i) Use GS1-compliant formats (e.g., GTIN, SSCC, GRAI, GIAI).

   ii) Include serial numbers, batch/lot numbers, and expiration dates where applicable.

b) Life cycle management

   i) Track UID status: issued, used, expired, revoked.

   ii) Prevent duplication or reuse of identifiers.

c) Audit trail

i) Log UID issuance, modification and status change events with timestamps, user roles, and associated products, to form a complete auditable log.

d) User access control

i) Role-based permissions for UID generation (e.g., manufacturers, regulators).

7.1.2 The traceability platform shall support configurable UID templates that comply with country-specific and product-specific standards.

7.1.3 The traceability platform shall be equipped with mechanisms to interoperate with other national or regional traceability platform by requesting new UID or synchronising the existing codes. This ensures interoperability, data consistency, and regulatory compliance across borders or jurisdictions.

7.1.4 All UID shall be encoded and affixed to products or packaging as data matrix symbols (any format) (see Figure 1) or QR Codes (See Figure 2) printed or affixed on physical products or packaging.

Figure 1. Example of data matrix symbols

Figure 2. Example of QR Codes

7.2 Centralised repository

The traceability platform shall maintain a centralised repository for the submission and storage of traceability data. All CTEs and KDEs shall be reported in accordance with country-specific and product-specific standards and submitted within 24 hours of event occurrence. Delayed submissions shall include a detailed explanation and shall be reported to the regulatory authority.

7.3 Interoperability and cross-chain capability

The traceability platform shall support cross-chain data exchange protocols to facilitate cross-border trade. When interacting with external blockchain-based traceability platform, it shall use trusted cross-chain protocols to ensure data immutability, authenticity, and consensus between jurisdictions.

7.4 Data security

The traceability platform shall comply with

a) data privacy laws and relevant regulatory directives in the jurisdictions where its business is conducted.

b) information security management system standards (e.g. ISO/IEC 27001)

8. Functional modules

8.1 The traceability platform should be modular for integration with business operation systems such as ERP (Enterprise Resource Planning), WMS (Warehouse Management System), and CRM (Customer Relationship Management) systems, and scalable for different supply chain sizes.

8.2 The traceability platform shall adopt modular architecture, allowing stakeholders to subscribe to relevant modules based on their business function.

8.3 Each module shall include:

a) API to secure authentication and authorisation via access token mechanism, using OAuth 2.0 or similar industry-standard protocol.

b) Automatic synchronisation and event reporting to the centralised repository.

c) The capability for seamless integration with stakeholders' internal business operation systems (e.g., ERP, Manufacturing Execution System (MES), WMS).

Table 1. Modular design

Module	Description
Serialisation module	Assigns and manages unique identifiers (e.g., GTIN + serial) for individual product units. Enables digital labeling and automatic linkage with the traceability repository.
Aggregation module	Links serialised items into logistic units (e.g., carton, pallet) for hierarchical traceability. Supports parent-child relationships and simplifies logistics management.
Inventory module	Tracks stock levels, enables First In First Out (FIFO)/Last In First Out (LIFO) tracking and supports alerts for expiry and recalls. Provides digital record of product inflow/outflow at the facility level, ensuring real-time inventory traceability and product status monitoring.
Warehouse module	Digitises storage operations, enables FIFO/LIFO tracking and enables location-based tracking of products within warehouses. Supports warehouse-level batch segregation for example halal and non-halal items.
Transportation module	Tracks item-level shipment movements and logistics records such as dispatch, transit, and arrival. Ensures data integrity during transportation, i.e., accurate, complete, tamper-proof throughout halal logistic transit.
Distribution module	Manages distribution channel activities, ensuring product compliance up to retail or export checkpoints. Supports product recall traceability.
Query module (Public access)	Enables public or authority-level verification of product status and product origin by scanning product QR Code or Data Matrix. Enhances consumer trust and transparency.

9. Application Programming Interface

9.1 The traceability platform shall provide a comprehensive set of APIs that enable seamless integration with external systems.

9.2 The API specifications shall support:

a) Event submission and retrieval for all CTEs and KDEs.

b) Data querying for verification, reporting, and analytics.

c) Secure authentication and authorisation through Access Tokens (e.g., OAuth 2.0 or similar industry-standard protocol).

9.3 The APIs shall be compatible with the stakeholders' business operation systems, allowing them to retain their existing systems while connecting to the traceability platform infrastructure.

9.4 The APIs layer should be readily accessible, standardised, and version-controlled, to promote ecosystem participation and innovation.

10. Industry application/use case

10.1 General

This industry application/use case illustrates the implementation of urban farming and transportation traceability based on real-world applications and requirements.

The objective is to demonstrate comprehensive end-to-end visibility of the supply chain while ensuring data integrity, compliance, and traceability.

The urban farming and transportation traceability form integral components of the traceability platform, providing a unified digital environment for system operators, certification bodies, and consumers.

10.2 System architecture overview

10.2.1 The use case "*iTrace* Traceability Platform" architecture is organised into multi-layered components, as illustrated in Figure 3, each serving a specific function within the overall traceability framework.

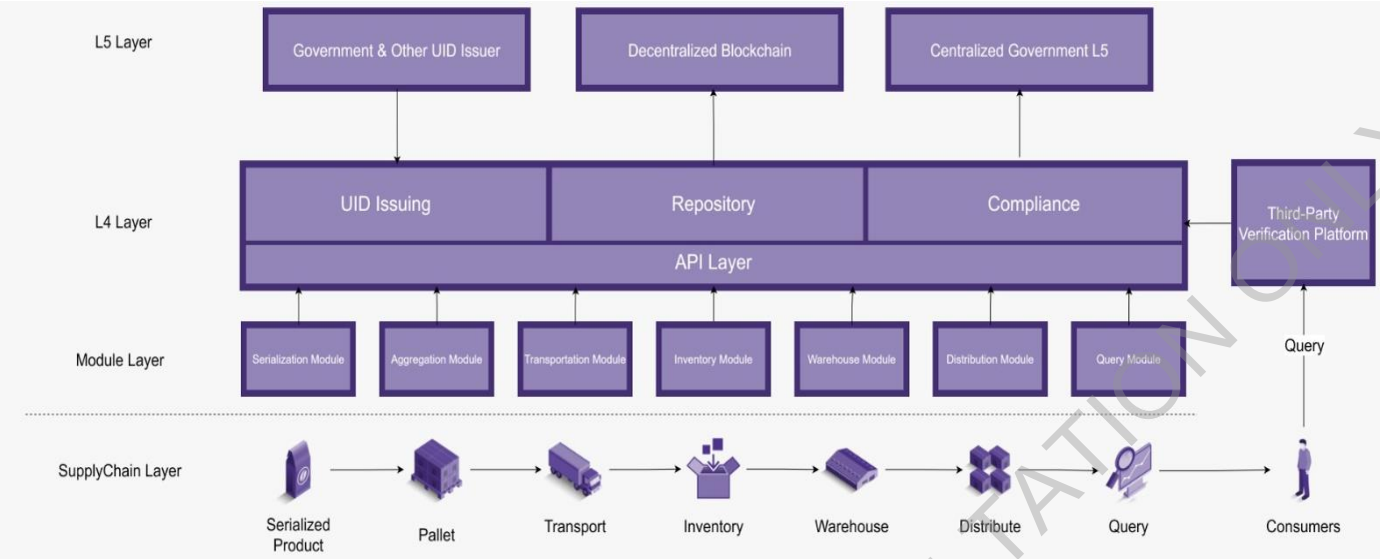


Figure 3. Overall architecture of the "*iTrace* Traceability Patform"

10.2.2 L5 Layer - Governance and trust framework

This layer represents the highest level of governance, encompassing:

a) Government and other UID issuers: Authorised entities responsible for issuing UID for products, assets, or shipments;

b) Decentralised blockchain: Provides tamper-proof, distributed storage of event records, ensuring transparency and data immutability; and

c) Centralised government L5: Acts as a national oversight node for validation, compliance monitoring, and cross-border interoperability with other trusted networks.

10.2.3 L4 Layer - Core traceability services

This layer manages the core functionalities that support traceability operations across industries:

a) UID issuing: Generates and manages UID such as GTIN, GLN, and SSCC, following GS1 standards.

b) Repository: Serves as the centralised repository, securely storing both master data (e.g., product, location, and process definitions) and transactional data (EPCIS events).

c) Compliance: Ensures that all recorded data and operations adhere to the Regulatory Traceability Framework, audit policies, and international standards.

d) API Layer: Provides secured API endpoints for module-to-module and system-to-system communication, enabling external system integration.

10.2.4 Functional module layer

The module layer represents industry-specific modules that interact with the traceability platform through APIs.

10.2.5 Third-party certification and consumer query layer

Data from the compliance layer flows to the third-party verification platform, allowing external authorities or consumers to validate product authenticity and traceability status. Through the query module, end users can scan QR codes to view event histories, ensuring transparency and consumer confidence.

10.2.6 Supply chain layer - Physical and digital convergence

This layer represents the physical flow of goods – from raw material acquisition, production, processing, packaging, warehousing, transportation to distribution and retail - all digitally mirrored by the system through EPCIS events. Every transaction or movement generates a verifiable digital record, connecting the real-world supply chain to the digital traceability ecosystem.

10.3 Process flow

The “iTrace Traceability Platform*”* process follows the EPCIS event model, capturing the four critical data attributes: What, Where, When, and Why to form a complete and verifiable record for each stage of production. All events are automatically submitted to the centralised repository within 24 hours of occurrence, ensuring compliance with this standard.

Table 2. EPCIS event information content to be recorded

Dimension	Data element	Contents
	Event type	Defines the type of event recorded. (e.g., object/ transformation/ aggregation event)
	Action	Identifies whether items were created, observed, or removed. (e.g., observe/ add/ delete)
What	EPC list	List of serialised EPC identifiers. (e.g., urn:epc:id:sgtin:Company.ABCGroundCoffee.SerialNo)
When	Event time	Timestamp of when the event occurred. (e.g., Sep 23, 2012, at 10:12am UTC)
Where	Business location	The location where the object(s) is considered to currently reside until a subsequent event takes place. (e.g., urn:epc:id:sgln:CompanyPrefix.LocationReference. Extension)
	Read point	The location where the event took place. (e.g., urn:epc:id:sgln:CompanyPrefix.LocationReference. Extension)
Why	Business step	Describes the business process step. (e.g., urn:epcglobal:cbv:bizstep:inspecting)
	Disposition	Describes the product status. (e.g., active, in_progress, in_transit)

10.4 Sector example

Sector examples for traceability platform in urban farming and transportation module are illustrated in detail in Annexes A and B.

Annex A
(informative)

Sector example - Urban farming traceability

A.1 General

The urban farming traceability is a solution, adopted by a collaborative project where SIRIM Berhad aims to build an ecosystem for the urban farming industry, facilitating innovation and driving the adoption of technology in the industry. Working together with the "iTrace Traceability Platform", the urban farming traceability is built into the farm to track the life cycle of the farming process from seed to retail (see Figure A.1), to ensure transparency of the process, and provide visibility of verified information to consumers.

Figure A.1 Process flow of urban farming

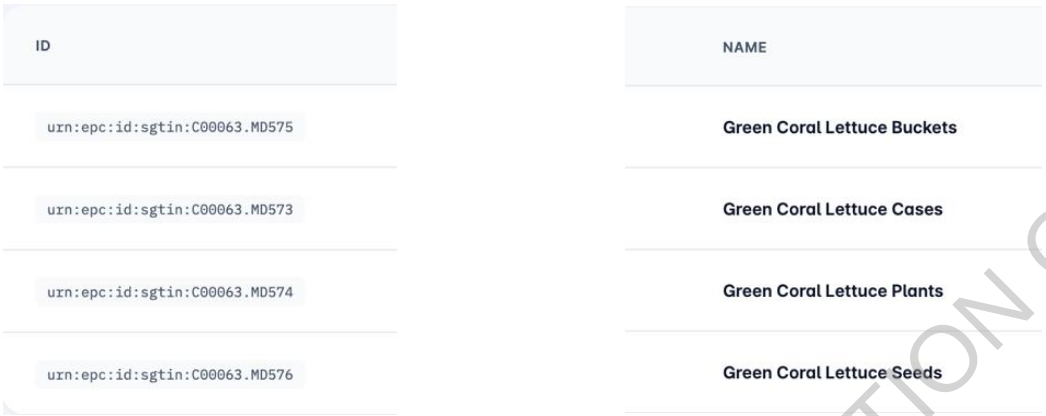
A.2 GS1 identification

The urban farming traceability within the "iTrace Traceability Platform", adopts the GS1 system of identification keys to ensure interoperability and globally recognised product identification across all stages of the supply chain.

A.2.1 GTIN (Global Trade Item Number)

The EPC classes, such as green coral lettuce seeds and green coral lettuce plants, are assigned unique GTIN identifiers in accordance with the GS1 standard (urn:epc:id:sgtin:Company.ItemReference.Extension).

This allows consistent item-level identification throughout the traceability process.



ID	NAME
urn:epc:id:sgtin:C00063.MD575	Green Coral Lettuce Buckets
urn:epc:id:sgtin:C00063.MD573	Green Coral Lettuce Cases
urn:epc:id:sgtin:C00063.MD574	Green Coral Lettuce Plants
urn:epc:id:sgtin:C00063.MD576	Green Coral Lettuce Seeds

Figure A.2 EPC items assigned with GTIN GS1 standard

A.2.2 GLN (Global Location Number)

Each production and operational site is assigned a GLN prefix (urn:epc:id:sgln:CompanyPrefix.LocationReference.Extension), ensuring accurate location referencing and event mapping across the network.

ID	NAME
urn:epc:id:sgln:C00063.S00080.MD851.ST1	Aquaponic Fish Tank
urn:epc:id:sgln:C00063.S00080.MD847	Vertical Shrimp Area
urn:epc:id:sgln:C00063.S00080.MD851	Vertical Tower
urn:epc:id:sgln:C00063.S00080.MD848	Vertical Tower & Growbed Area
urn:epc:id:sgln:C00063.S00080.MD562	Wicking Bed Area
urn:epc:id:sgln:C00063.S00080.MD562.BD1	Wicking Bed Unit 001

Figure A.3 Business location assigned with GLN GS1 standard

NOTE. The extension component in the GLN or GTIN allows for greater granularity in identifying sub-locations or subclasses within a site or product group.

For example, within a planting facility, sub-locations such as vertical tower or wicking bed area are defined by appending an extension to the existing GLN.

Table A.1 Example location GLN format ID with extension

Type	ID	Name
Planting facility	urn:epc:id:sgln:C00063.S00080.MD851	Vertical tower
Planting facility	urn:epc:id:sgln:C00063.S00080.MD562	Wicking bed area
Planting facility	urn:epc:id:sgln:C00063.S00080.MD562.BD1	Wicking bed unit 001

If a new business location such as a wicking bed unit 001 is added within wicking bed area, its identifier would be represented as urn:epc:id:sgln:C00063.S00080.MD562.BD1, reflecting the hierarchical relationship and enabling precise traceability of events within that environment.

A.3 Event reporting based on EPCIS standard

Object event representing a digital record of a real-world agricultural activity. The event follows the EPCIS model's four core attributes - What, When, Where, and Why - and incorporates blockchain-based integrity and internal identifiers for robust traceability management (Refer to Figure A.4).

- The event type is object event, indicating the observation of one or more physical products.
- The action is OBSERVE, meaning the system detected an existing object in a specific state without modification.
- The "when" attributes, the event time records when the fertilising activity occurred, while the record time captures when this data was uploaded and stored in the traceability system.
- The "where" attributes identify the read point ("Farm PDA") - where the data was captured - and the business location ("Wicking Bed Area") - where the event physically took place.
- The "why" attributes define the business step as fertilising and the disposition as in progress, signifying that the production process is ongoing.
- The "what" attributes list 10 counts of EPC items (urn:epc:id:sgtin:C00063.MD574.1763351274477), linking the event to specific traceable product instances.
- The blockchain hash (n14IKBhF+6p3KjXAjO1oVVs12YFVzBpB1pv8i5hMhUI) ensures data immutability and integrity, aligning with the standard.
- The identification section (including saga event ID, partition, and original event ID) uniquely identifies and connects related events across the product life cycle.

This structure ensures that every CTE is digitally captured with verifiable data integrity, supporting end-to-end traceability and regulatory compliance.

Event Details

Type

Event Type	ObjectEvent
Action	OBSERVE

When

Event Time	2025-06-04T00:00:00.000Z
Record Time	2025-11-17T03:47:57.663Z

Where

Read Point	Farm PDA
Business Location	Wicking Bed Area

Why

Business Step	Fertilizing
Disposition	In Progress

What

Quantity List	10 count: urn:epc:id:sgtin:C00063.MD574.1763351274477

Extension

saga:blockchain_hash	n14lK8hF+6p3kjXAjO1aVVs12lYFvZpB1pv8i5hMhul

Identification

Saga Event ID	34b2bef0-c368-11f0-9b6e-915bacc63122
Partition	1763348400096
Original Event ID	251f08ee-1315-4834-874c-f3fcaa82c878

Figure A.4 Example of event based on EPCIS standard

A.4 UID requesting from the traceability platform

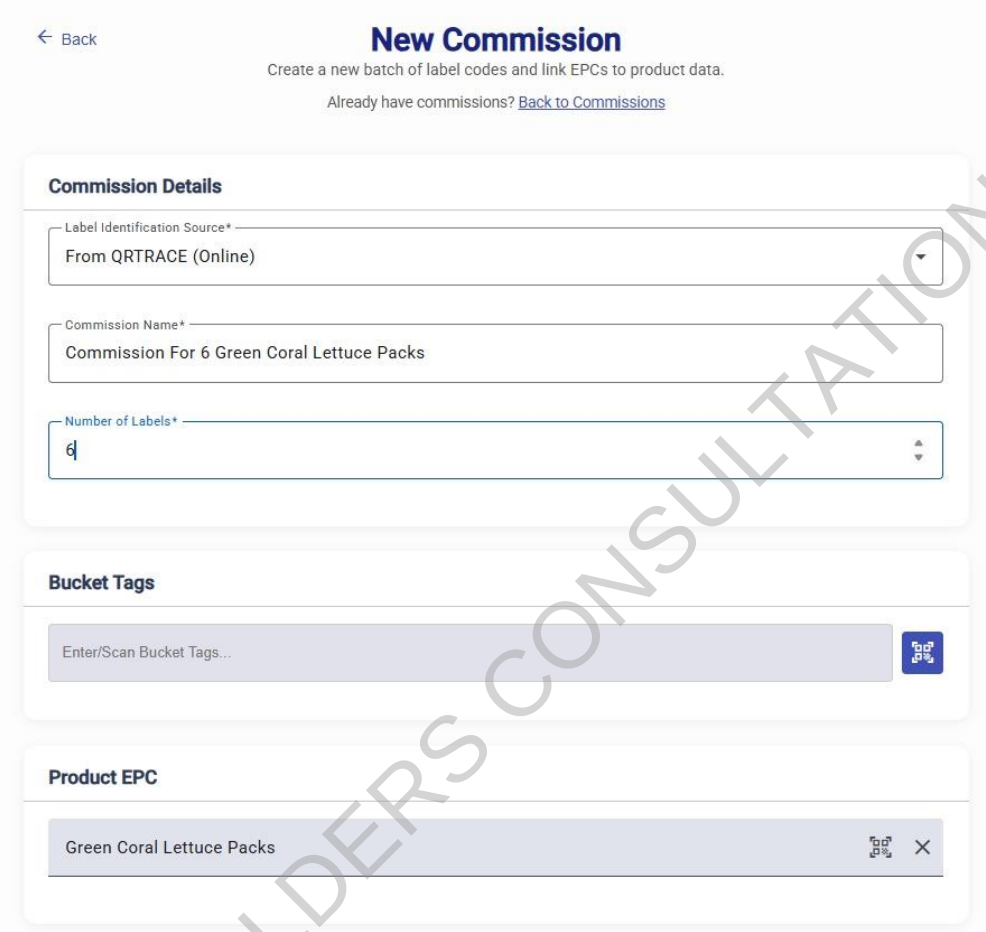


Figure A.5 Addition/Iniiation of new commission event in urban farm module

When a user initiates a new commission event, the system automatically requests the required number of UID from the platform's UID Issuing Service.

Figure A.6 Example of UID requested from "iTrace Traceability Platform"

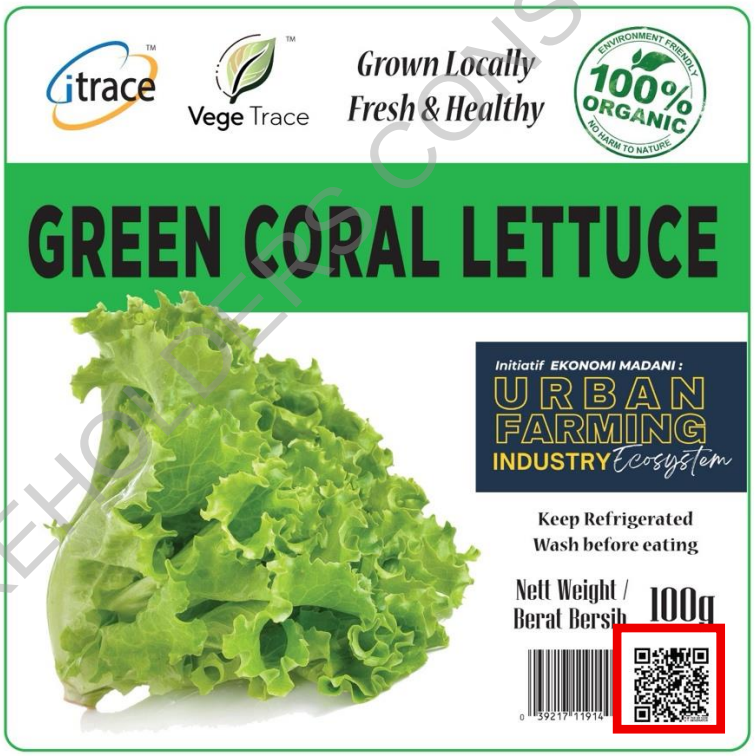


Figure A.7 UID print on vegetable packaging label

A.5 Centralised repository function

The centralised repository serves as the core data hub of the “iTrace Traceability Platform”, securely consolidating all traceability records from various interfaces and modules.

Whenever users add or update data (e.g. master data or EPCIS events) through the web interface, the repository is immediately updated in real time.

ID	NAME
urn:itrace:cbv:bizstep:aggregating	Aggregating
urn:itrace:cbv:bizstep:commissioning	Commissioning
urn:itrace:cbv:bizstep:decommissioning	Decommissioning
urn:itrace:cbv:bizstep:delivered	Delivered
urn:itrace:cbv:bizstep:destroying	Destroying
urn:itrace:cbv:bizstep:disaggregating	Disaggregating
urn:itrace:cbv:bizstep:fertilizing	Fertilizing
urn:itrace:cbv:bizstep:harvesting	Harvesting

Figure A.8 Business step master data stored in centralised repository

When a user submits a planting event via the urban farming interface (refer to Figure A.9), the event is instantly reflected within the repository (refer to Figures A.10 and A.11), ensuring transparency and synchronisation across all system modules.

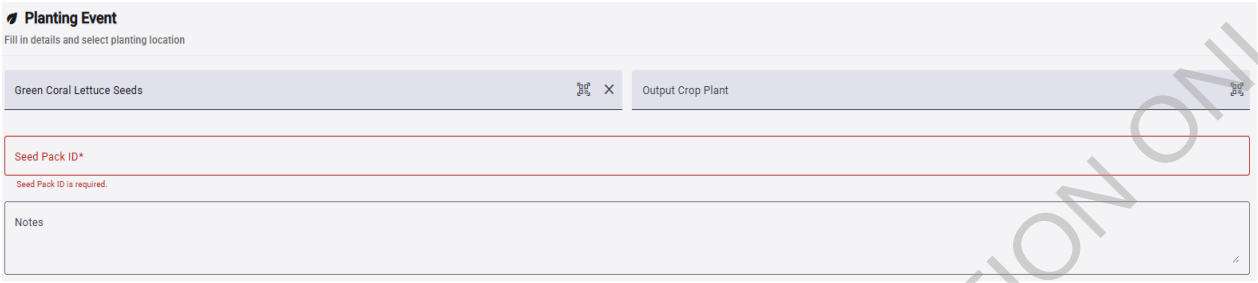


Figure A.9 Planting event submit via urban farm UI

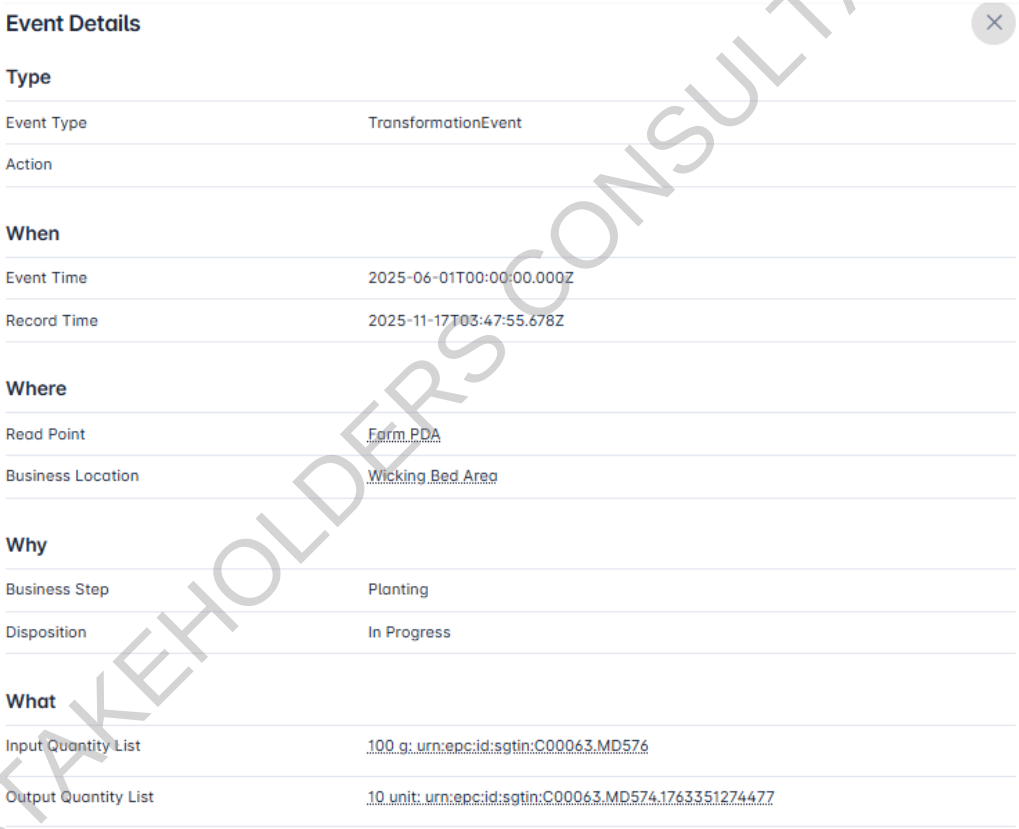


Figure A.10 Record of submitted planting event

This centralised structure ensures data consistency, facilitates efficient audit retrieval, and enables real-time compliance verification in alignment with regulatory and traceability requirements.

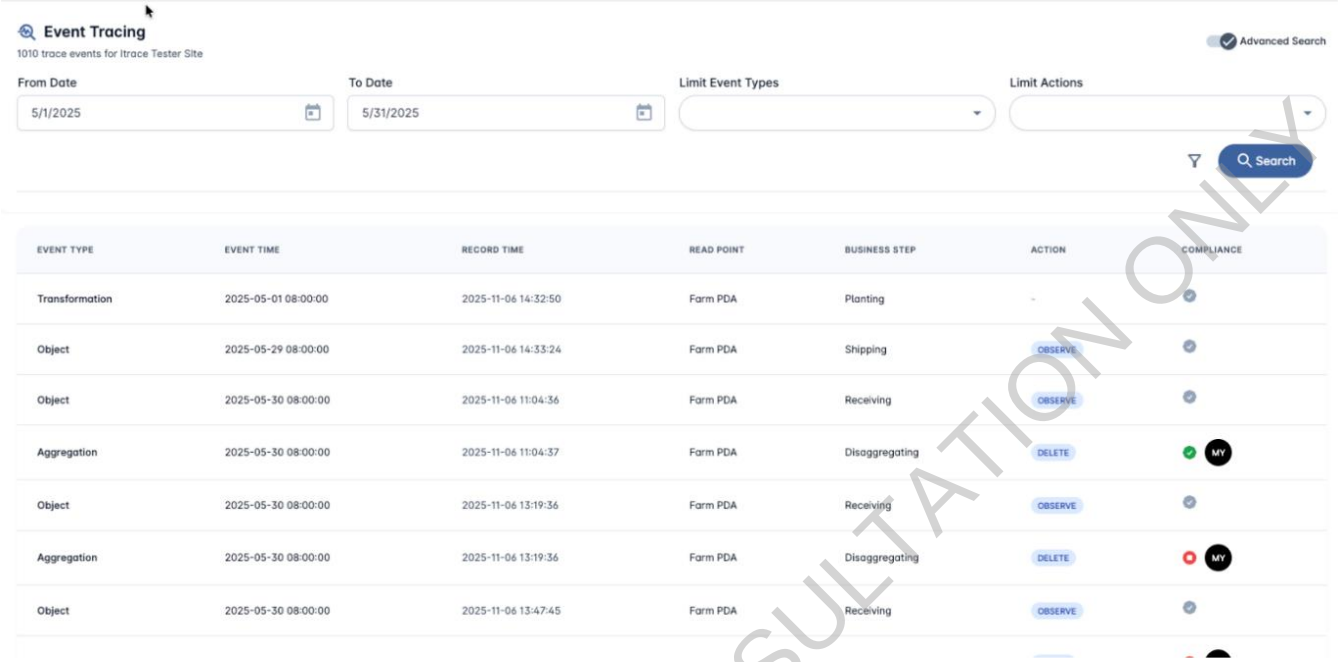


Figure A.11 List of events in centralised repository

A.6 Query and verification module

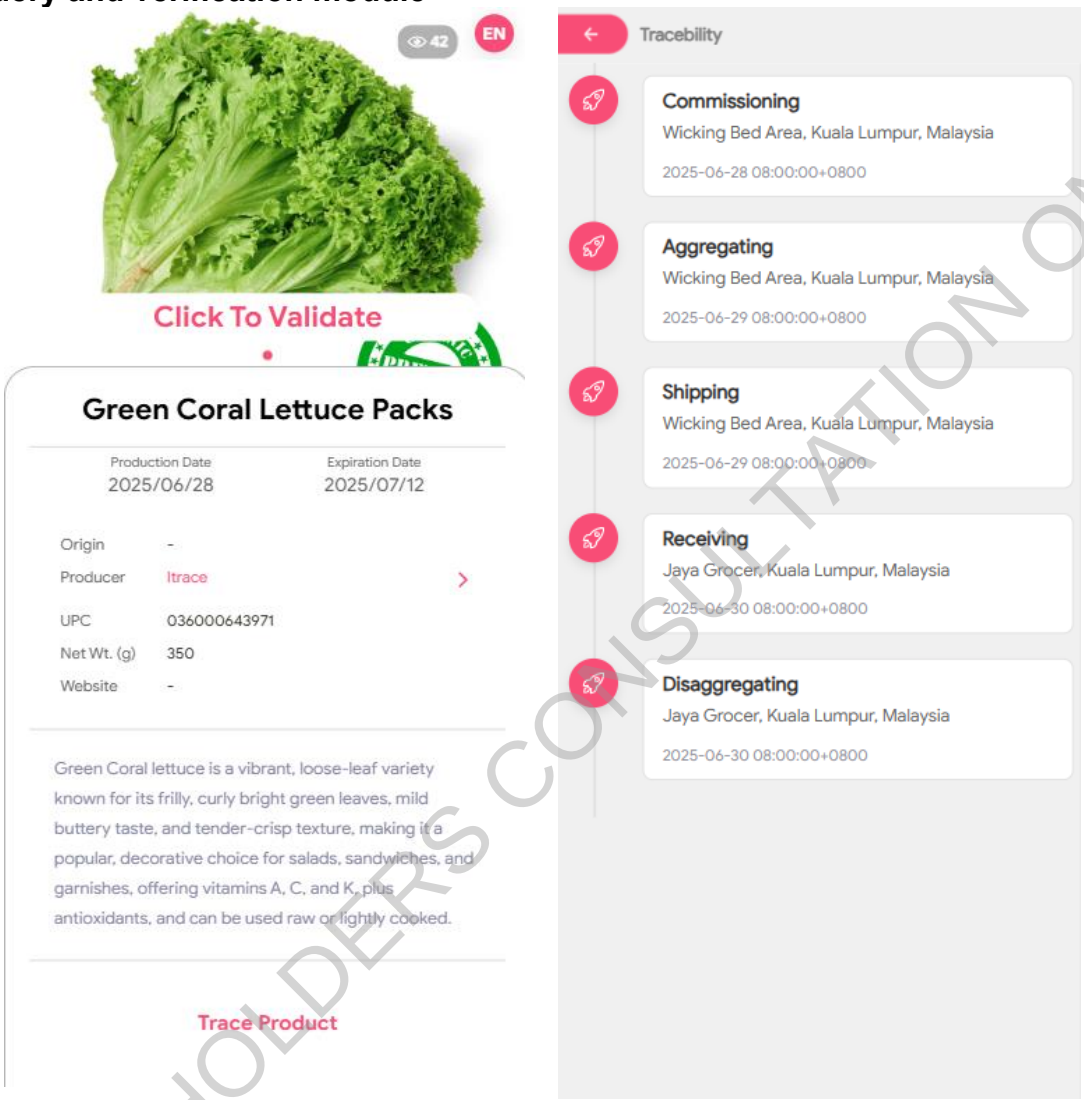


Figure A.12 Query module interface displaying traceability details upon QR code scan

The query module allows consumers to view verified product origin and event history by scanning the QR code on the packaging. This feature enhances consumer trust and supports public transparency, bridging the digital traceability data from farms to market.

Annex B
(informative)

Sector example - Transportation traceability

B.1 General

Transportation traceability is a collaborative initiative with the “iTrace Traceability Platform”, Malaysia Digital Economy Corporation (MDEC) and Biforst, designed to strengthen end-to-end traceability and monitoring of cold-chain logistics shipments.

The project utilises Internet of Things (IoT) technologies to capture real-time traceability data, including GPS location, temperature, and humidity, throughout the transportation life cycle. This enables continuous condition monitoring, enhances supply chain transparency and visibility, and ensures compliance with cold-chain requirements (see Figure B.1).

By supporting item-level traceability, the platform improves supply chain integrity, accountability, and consumer confidence through verifiable and auditable shipment data.

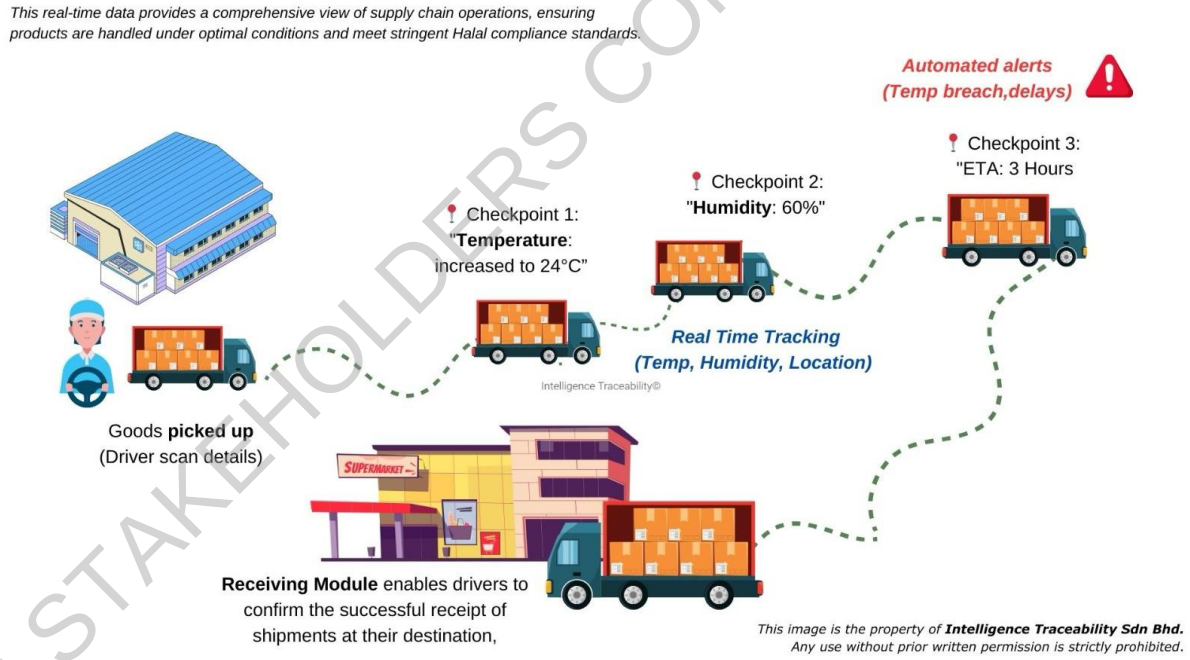


Figure B.1 Process flow for IoT-monitored cold-chain logistics

B.2 GS1 identification

The transportation traceability within the “iTrace Traceability Platform” adopts the GS1 System of identification keys to ensure standardised, interoperable, and globally recognised product and logistics identification throughout all stages of the supply chain. This enables seamless integration between shipping, packaging, and receiving processes under a unified traceability framework.

B.2.1 GTIN (Global Trade Item Number)

Each product class, e.g, ABC Ground Coffee and ABC 24pcs box, is assigned a unique GTIN identifier in compliance with the GS1 standard format (urn:epc:id:sgtin:Company.ItemReference.Extension). This guarantees consistent, item-level traceability across production, aggregation, and shipment activities, facilitating end-to-end product visibility (see Figure B.2).

NAME	ID
ABC 24pcs box	urn:epc:id:sgtin:Company.ABCBox
ABC Ground Coffee	urn:epc:id:sgtin:Company.ABCGroundCoffee

Figure B.2 EPC items assigned with GTIN GS1 standard

B.2.2 GLN (Global Location Number)

Every production, warehousing, and logistics site is assigned a GLN prefix (urn:epc:id:sgln:CompanyPrefix.LocationReference.Extension) to accurately reference physical locations and operational sites within the traceability network. For instance, warehouse and production centre locations are uniquely identified to ensure precise event mapping and source verification (see Figure B.3).

ID	NAME
urn:epc:id:sgln:C00099.S00109.MD745	Persequor ApS Production Center
urn:epc:id:sgln:C00099.S00109.MD743	PPC Warehouse

Figure B.3 Business location assigned with GLN GS1 standard

B.2.3 SSCC (Serial Shipping Container Code)

Logistics units such as pallets and shipping containers are uniquely identified through the SSCC (urn:epc:id:sscc:CompanyPrefix.SerialReference), enabling full visibility and traceability of goods movement throughout the logistics chain - from origin to retail destination (see Figure B.4).

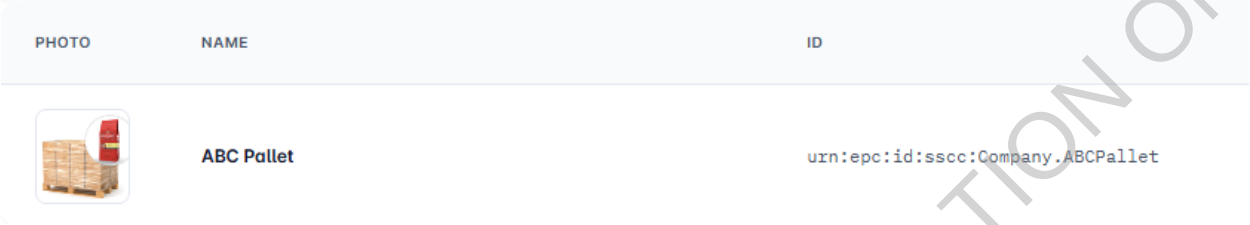


Figure B.4 EPC pallet assigned with SSCC GS1 standard

B.3 Event reporting based on EPCIS standard

Figure B.5 illustrates a recorded EPCIS Aggregation Event from “iTrace Traceability Platform”, serving as a digital record of a real-world packing and logistics aggregation activity.

The event conforms to the EPCIS four core attributes - What, When, Where and Why, and integrates blockchain-based data integrity mechanisms for verifiable and tamper-proof traceability.

- Event type: Aggregation event - representing the grouping of multiple product instances (EPCs) into a single logistics unit.
- Action: ADD - indicating that individual items have been physically aggregated into a parent container for shipment.
- When: Event time (2024-02-07T00:00:00.000Z) marks when the aggregation occurred, while record time (2025-11-11T09:18:17.614Z) logs when this event was captured in the traceability repository.
- Where: The read point (PPC Packer 2000) identifies the device or station that performed the aggregation, and the Business Location (Persequar ApS Production Centre) specifies where the operation took place.
- Why: The business step is defined as packing, and the disposition is defined as in progress, reflecting that the logistics process is actively ongoing.
- What: The parent ID (urn:epc:id:sgtin:Company.ABCBox.17628526291591) denotes the parent container or shipment unit, while the listed EPCs (e.g., urn:epc:id:sgtin:Company.ABCGroundCoffee.AS44H54DUQF, etc.) identify the individual packaged products aggregated within it.

– Extension: The blockchain hash (n14IKBhF+6p3KjXAjO1aVVs12YFVzBpB1pv8i5hMhup) provides cryptographic assurance of data immutability, ensuring event integrity in compliance with the standard.

This structured digital event ensures that every CTE associated with logistics aggregation and shipment is securely recorded, verifiable, and aligned with international traceability and assurance standards.

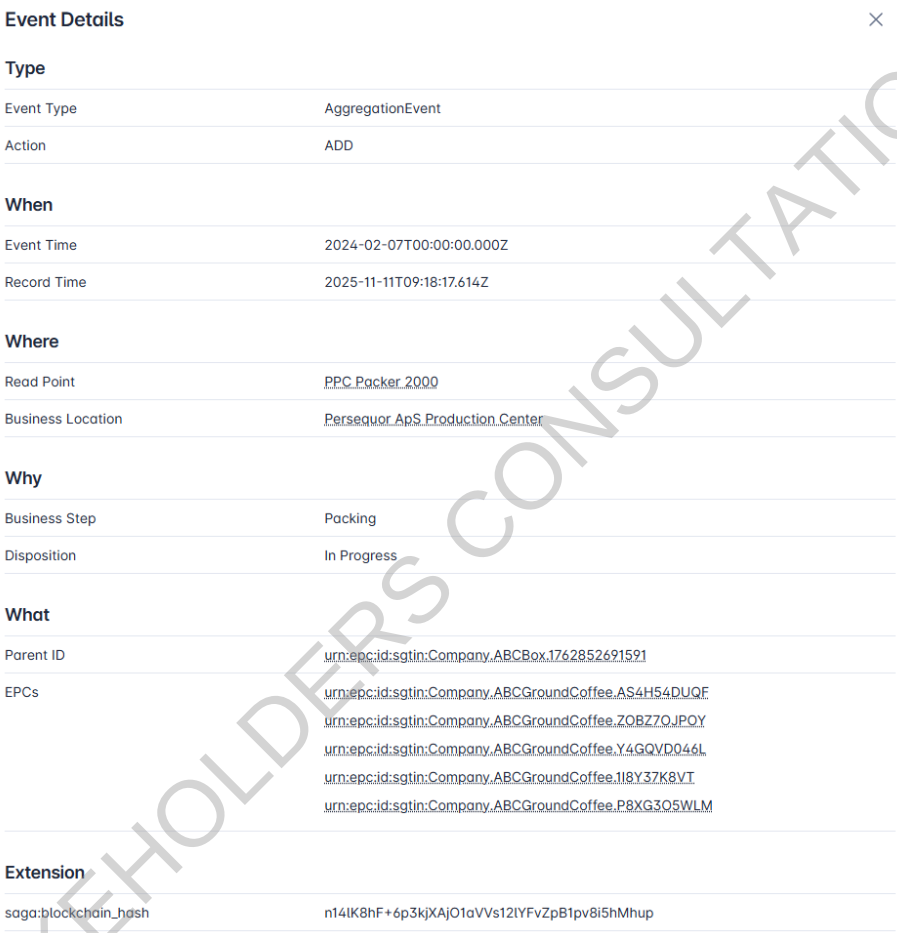


Figure B.5 Example of packaging event based on EPCIS standard

B.4 Centralised repository function

The centralised repository functions as the core data hub of the “iTrace Traceability Platform”, providing secure, unified storage for all traceability information submitted through various modules and interfaces (see Figure B.6). Every data entry – whether CTE or KDE is recorded in real time, ensuring synchronisation across the traceability ecosystem.

ID	NAME
urn:epc:id:sgln:C00098	ACME Distributor
urn:epc:id:sgln:C00098.S00108	ACME Melaka
urn:epc:id:sgln:C00117	Durian Demo Retailer
urn:epc:id:sgln:C00063	Itrace
urn:epc:id:sgln:C00063.S00078	Itrace site
urn:epc:id:sgln:C00063.S00080	Itrace Tester Site
urn:epc:id:sgln:C00063.S00078.MD786	Itrace Test New

Figure B.6 Source and destination master data stored in centralised repository

When a driver submits a shipping event through the transportation user interface (Figure B.7), the corresponding event is immediately reflected within the centralised repository (Figure B.8). This ensures that all supply chain stakeholders have access to synchronised and up-to-date shipping information.

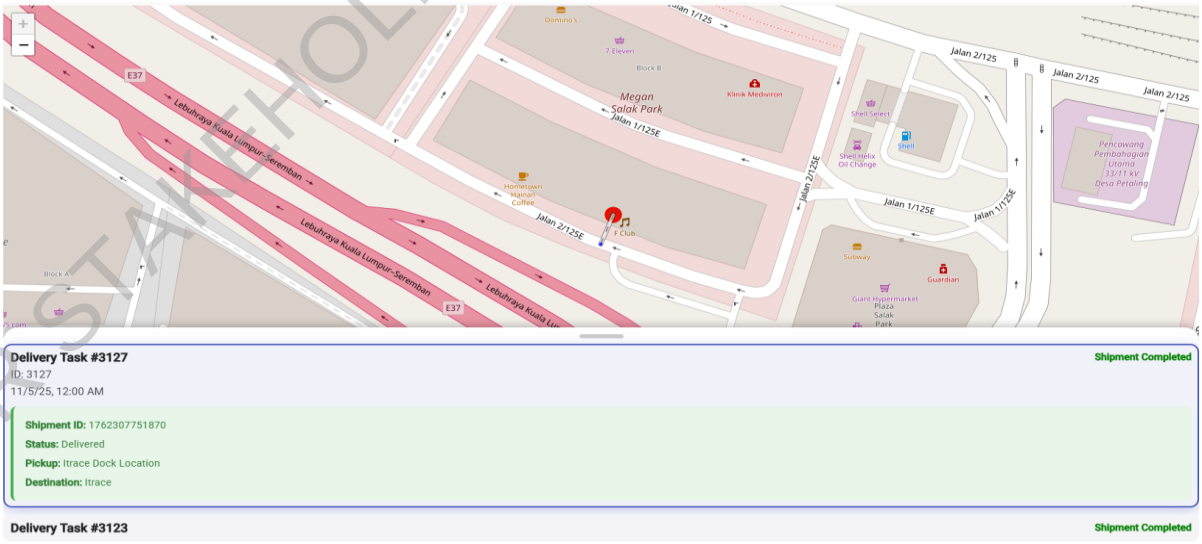


Figure B.7 Shipping event submitted via transportation UI

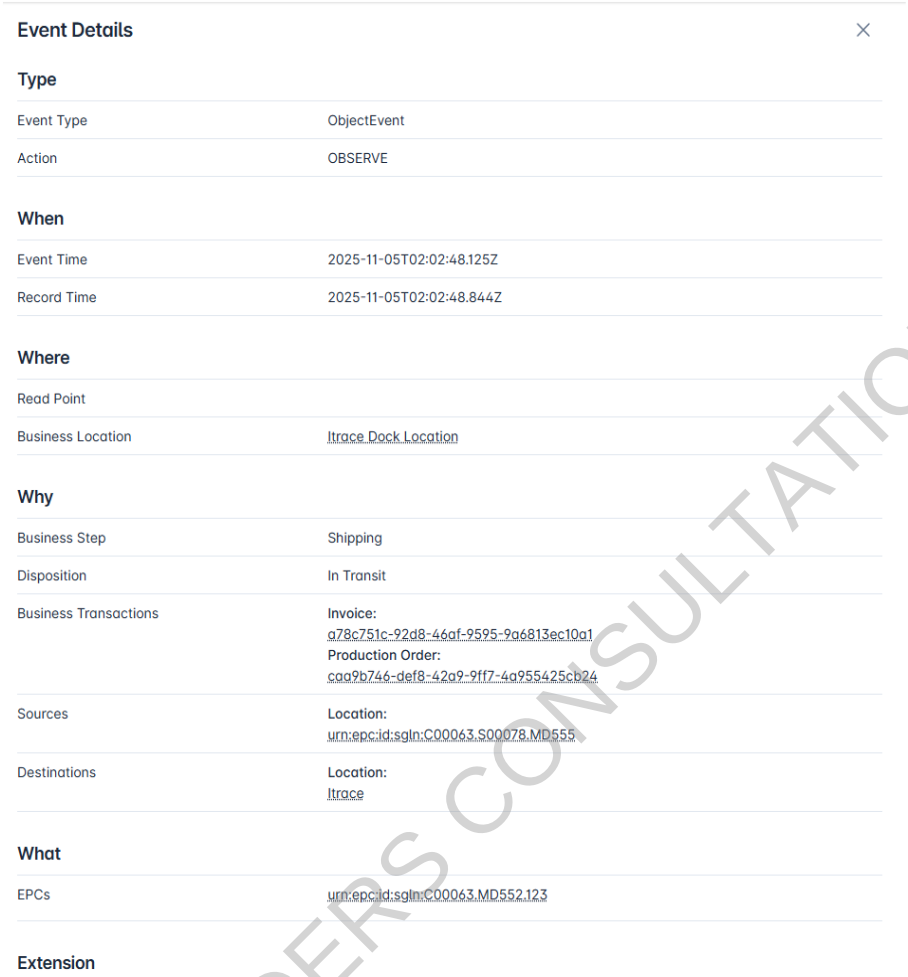


Figure B.8 Record of submitted shipping event

B.5 Extension of shipment event records

The extension section of each shipping event captures relational data elements such as the associated driver ID, shipment ID, and other related operational references (refer to Figure B.9). This demonstrates the Who attributes of an event, which indicates the operator involved in handling the object moving through the supply chain.

This allows the system to maintain a complete, traceable linkage between shipment records, transport vehicles, and responsible operators.

Extension

saga:DriverID	D1762306090125
saga:OrderID	ODR1762306279512
saga:ShipmentID	1762306630079
saga:VehicleID	V0821753

Identification

Saga Event ID	832bbf50-b9ef-11f0-9299-b77ffad4a3b8
Partition	1762308000243
Original Event ID	302bf774-f166-4a18-ba88-745947d9515b

Figure B.9 Extension section of shipment event record

B.6 GPS, temperature and humidity monitoring of shipment

The tracking component of the project is powered by Internet of Things (IoT) technologies, which enable the continuous capture of critical shipment data, including geolocation, temperature, and humidity. These sensors transmit real-time information throughout the transportation journey, enabling proactive condition monitoring and ensuring adherence to cold-chain handling requirements. This demonstrates How attributes, where sensor-based conditional information is captured during the transportation process (refer to Figures B.10 and B.11).

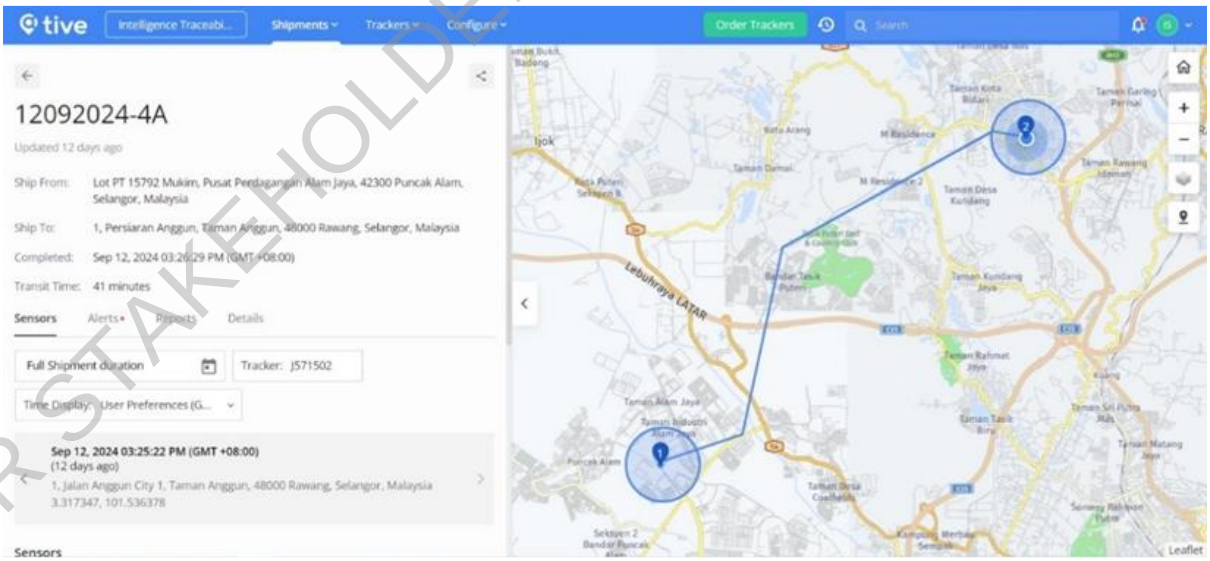


Figure B.10 Transportation tracker revealing GPS location and route

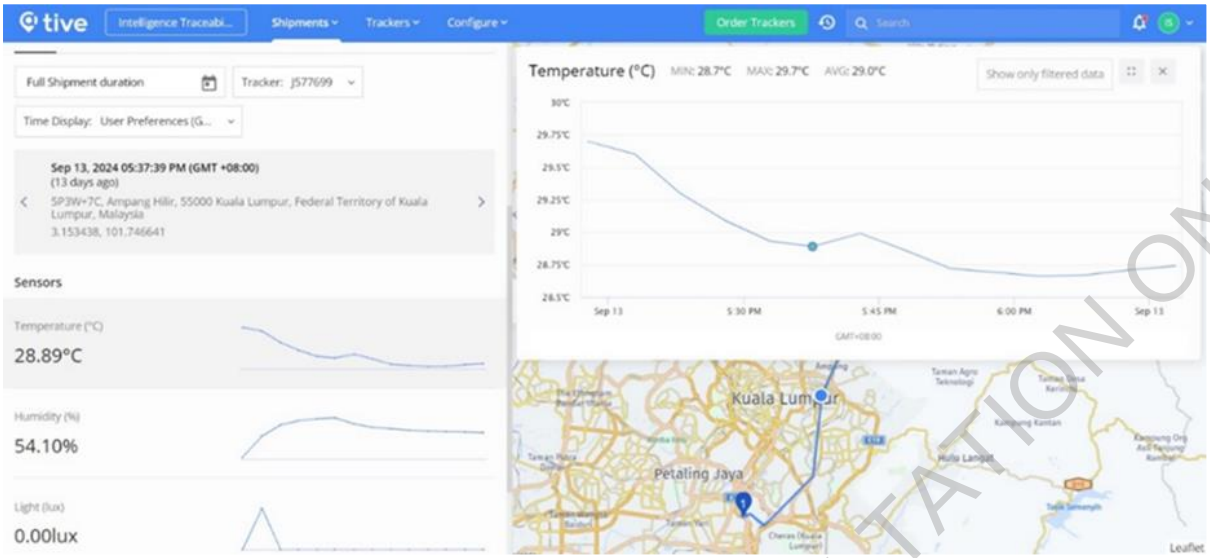


Figure B.11 Temperature and humidity of shipment monitored during transportation

By using the transportation user interface, authorised personnel can query a specific shipment ID to instantly retrieve all related records and operational details. This functionality strengthens accountability, transparency, and regulatory compliance across the logistics chain (refer to Figure B.12).

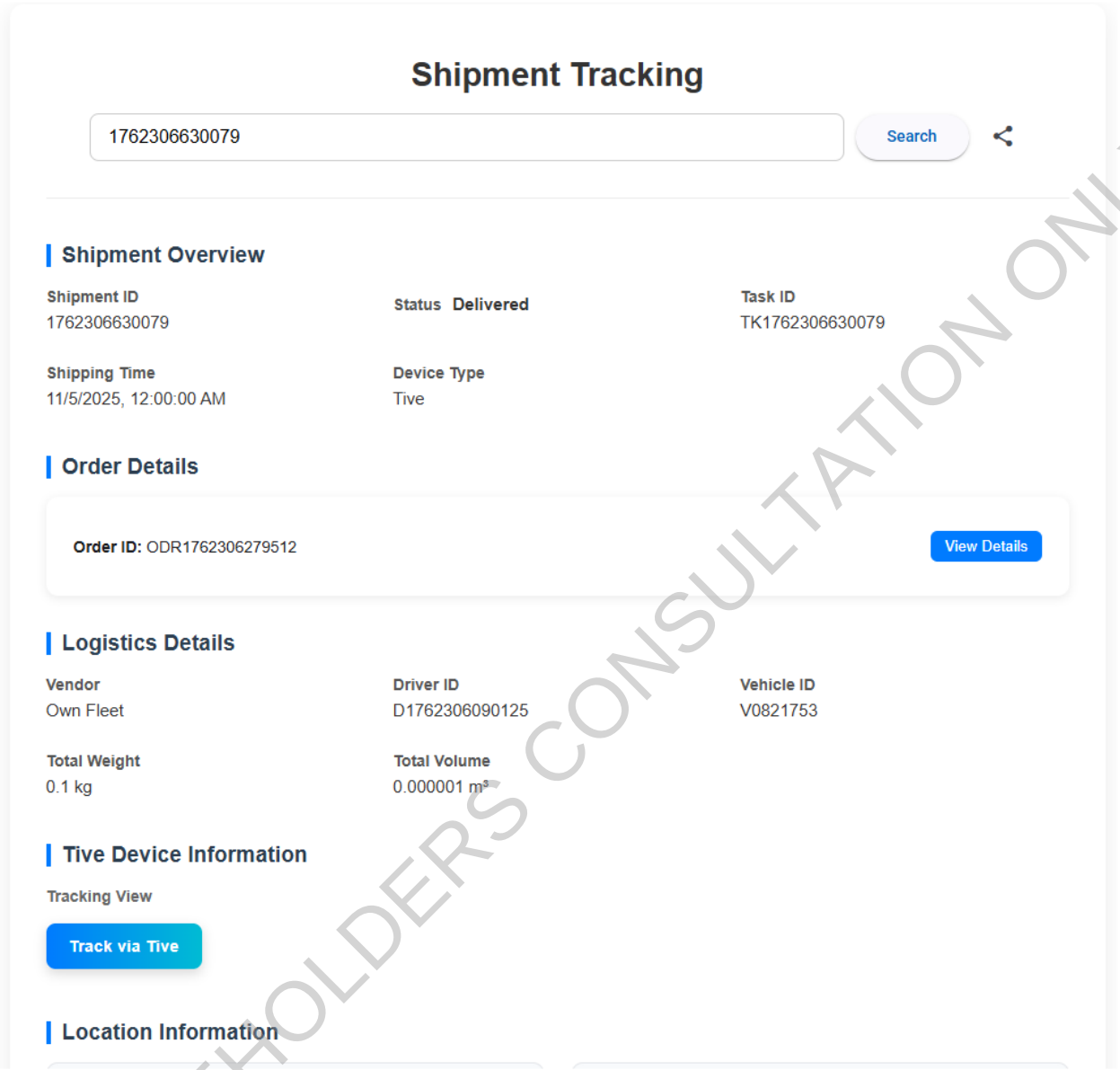


Figure B.12 Tracking shipment details via transportation user interface

Acknowledgements

SIRIM Berhad would like to thank the members of the Project Committee on Supply Chain Traceability Systems who have contributed their ideas, time and expertise in developing this standard.

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Mr Roland Wong Loke Aun	Malaysia Association of Product And System Certification
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