



UNIVERSITÀ DEGLI STUDI DELL'AQUILA



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Dipartimento di Ingegneria  
e Scienze dell'Informazione  
e Matematica

# Case Studies of Distributed Ledger Technology in Construction and Agriculture

**7<sup>th</sup> DLT Working Group Meeting 2025**

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**Giovanni De Gasperis**

[giovanni.degasperis@univaq.it](mailto:giovanni.degasperis@univaq.it)

**Sante Dino Facchini**





[santedino.facchini@univaq.it](mailto:santedino.facchini@univaq.it)

## Introduction – DLTW 2025

Case Studies of Distributed Ledger Technology in Construction and Agriculture

### DLT in IoT scenarios

Distributed Ledger Technologies are emerging as trustworthy infrastructures for real-world Internet of Things systems, ensuring transparency, traceability, and data immutability.

- 1  **Decentralized security** (no single point of failure)
- 2  **Immutable logs** to prevent tampering
- 3  **Cryptographic identity** for devices, improving authentication
- 4  **Decentralized Device Management**  
secure, distributed device registration

#### DLT in IoT

Distributed Ledger Technologies enable decentralized, tamper-proof, and auditable management of data in cyber-physical environments. Beyond financial use, these technologies have matured into enabling infrastructures for digital trust in public administration, engineering, and agriculture.

## Introduction – DLTW 2025

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### Dissemination Work

Two independent case studies that demonstrate the applicability of the technology in distinct operational domains:

1

#### **Constructions & Building documentation:**

Building Ledger Dossier (BLD) for digital documentation and seismic-damage mitigation in construction.

2

#### **Agriculture:**

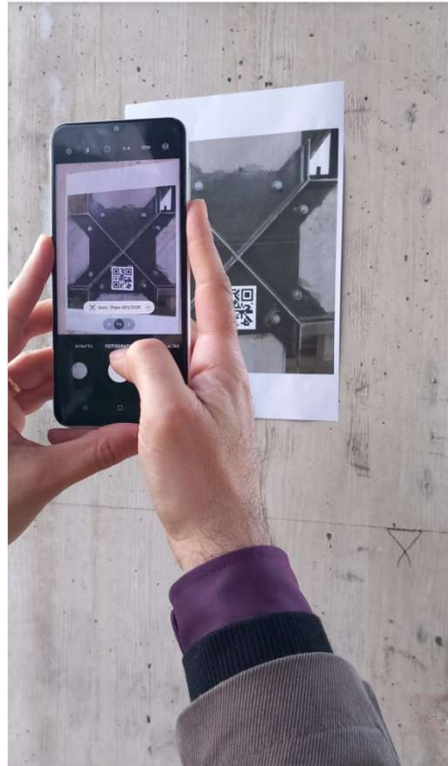
IOTA-based smart agriculture system for secure real-time monitoring.

# Applications: Trackability in Constructions – DLTW 2025

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## Practical Application

Distributed and verifiable framework for managing building documentation and post-event reconstruction evidence.



- Digital Twin models, implemented on **OpenSees**, for simulating structural behavior and documenting updates;
- **IPFS** decentralized storage for long-term archival of official documents;
- NFT-based certification to uniquely identify dossiers and related interventions, and visible on **OpenSea** public repository;
- **DAO-governed** workflows involving Installers, Engineers, and Directors of Works.



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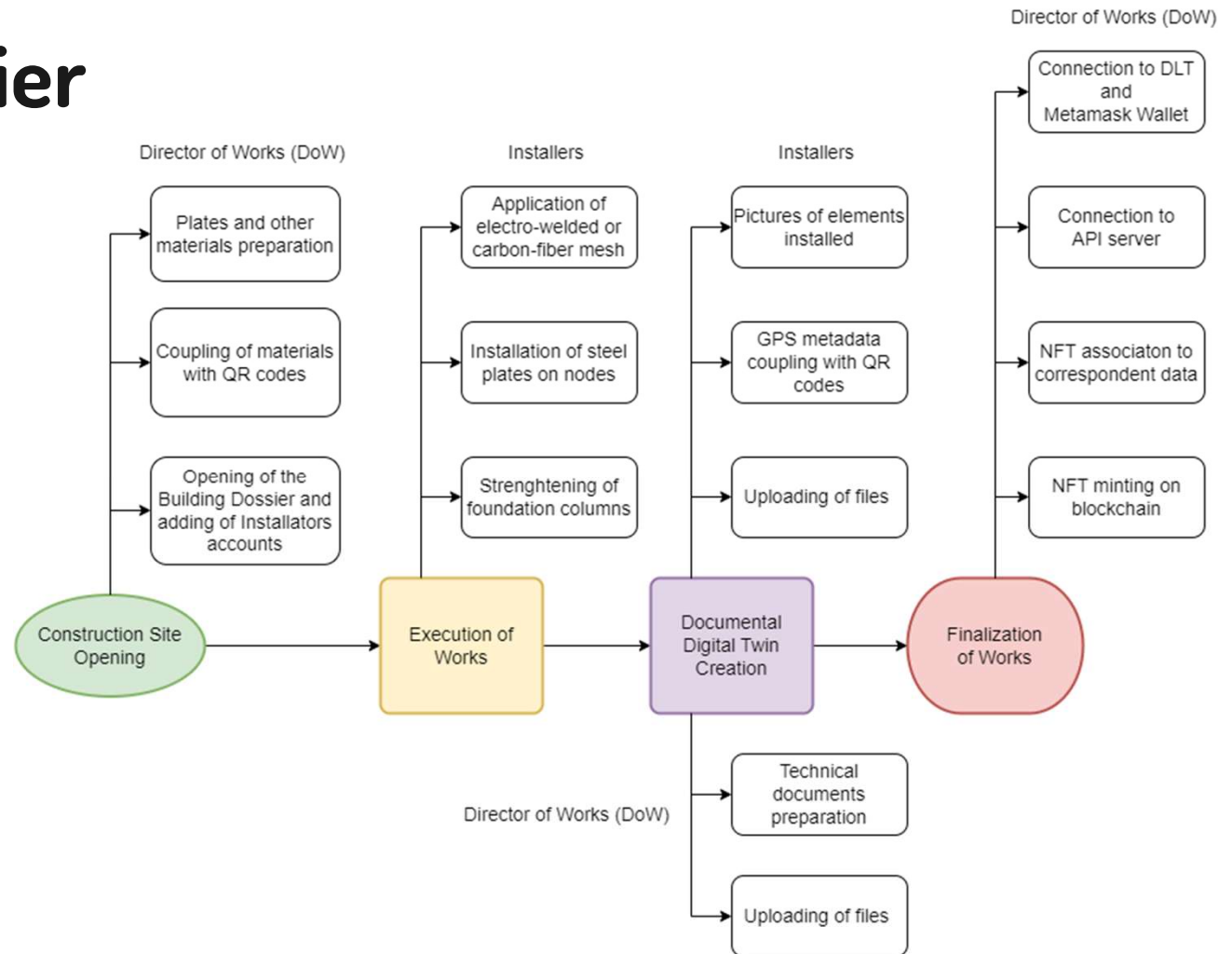
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# Applications: Trackability in Constructions – DLTW 2025

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## Building Ledger Dossier

G. De Gasperis, S. D. Facchini, A. Saeed, **Building ledger dossier: Case study of seismic damage mitigation and building documentation tracking through a digital twin approach**, Systems 13 (2025)529.



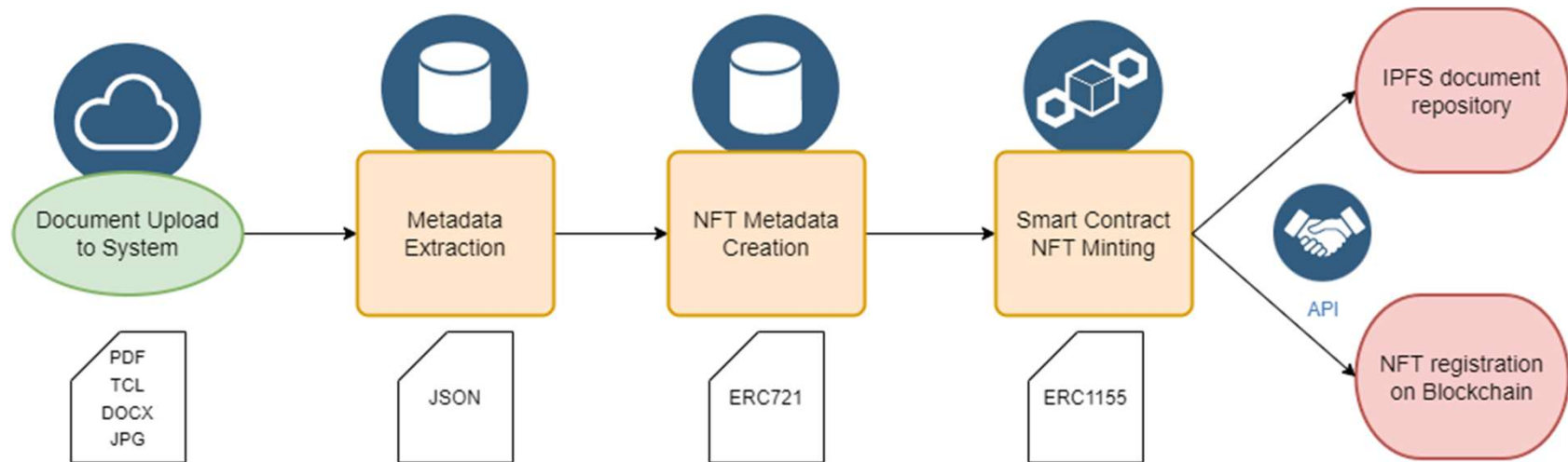
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# Tokenization Progress

Modeling of the tokenization process of Building Dossier's documents.



For each phase is reported the type of document involved and the sub-process (in white) and the medium used (in blue).

Once the documents are ready a smart contract provide to interact through API calls with DLT.

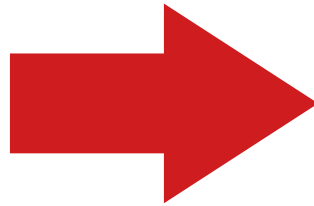


## Applications: IoT in Agriculture – DLTW 2025

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# RT monitoring with IOTA

"Monitoring Real-Time Data for Smart Agriculture using IOTA and IoT" (in publication EEE BCCA 2025 proceedings)



High Scalability

Low Latency

High Throughput

Feeless



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# Why we chose Move

**Security & Formal Verification:** Move provides strong safety through resource-oriented programming, preventing bugs like double-spending or data loss.

**Efficiency & Parallelism:** Move's modular design allows fast, parallel execution of smart contracts, improving IOTA's scalability.

**Asset-Native Model:** Move treats digital assets as first-class objects, fitting perfectly with IOTA's object-based ledger.

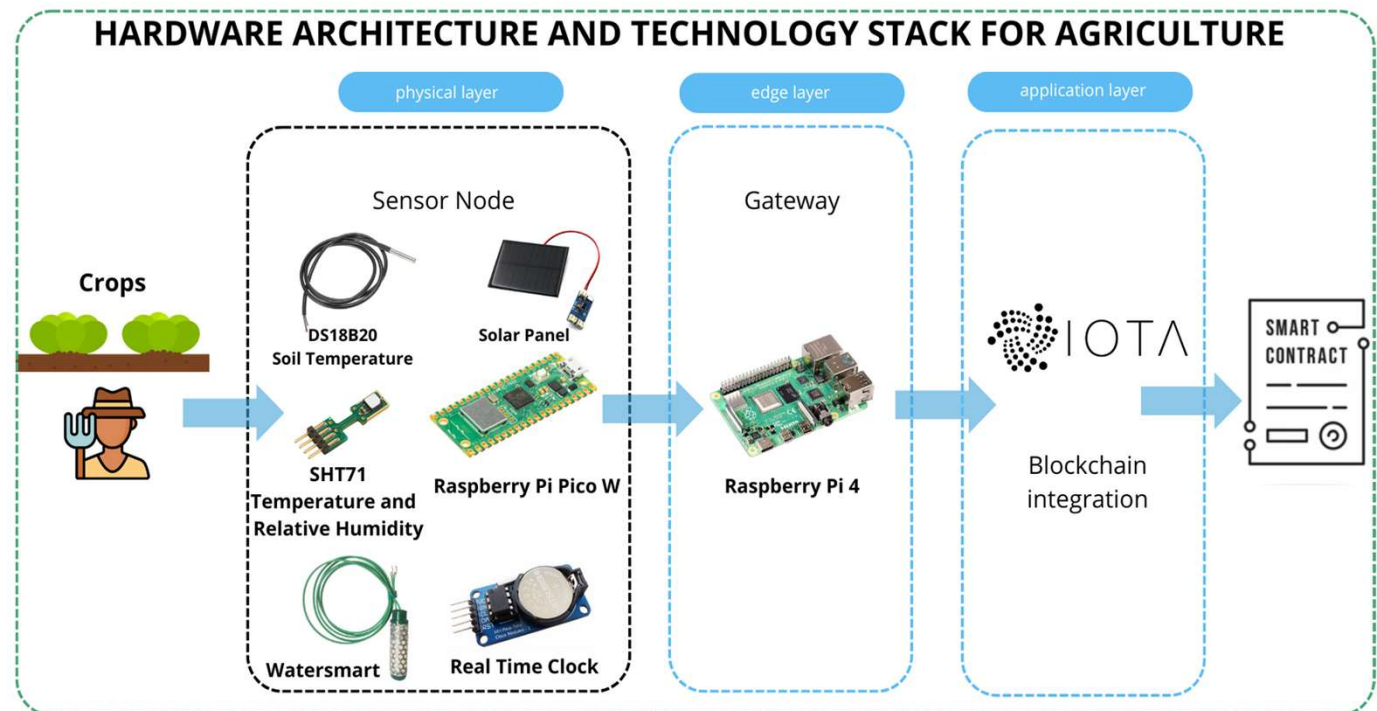
**Cross-Chain Interoperability:** Using Move aligns IOTA with other Move-based ecosystems (Aptos, Sui), enabling easier cross-chain decentralized application development.



## Technology Stack



Component	Current (mA)	Voltage (V)	Power (mW)	Description
Raspberry Pi Pico W	130 - 150	3.3	429 - 495	Data transmission
SHT171 Sensor	0.55 - 1.0	3.3	1.8 - 3.3	Brief consumption during measurement
DS18B20 Sensor	1.5	3.3	4.95	Low consumption per reading
Capacitive Soil Moisture Sensor	10 - 20	3.3	33 - 66	Consumption



# Applications: IoT in Agriculture – DLTW 2025

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# Results

Functions	IOTA gas cost	USD gas cost
log_sensor_data	.001 IOTA	0.00023\$
is_within_range	.001 IOTA	0.00023\$
is_time_in_range	.001 IOTA	0.00023\$
verify_sensor_data_with_ranges	.001 IOTA	0.00023\$

```
shahid@shahid: ~/dev/IOTA/first_package/source$ python execute_smart_contract.py
Connected to port /dev/ttyACM0. Receiving data...
Data received: Sensor ID: 1; Temperatura ambiente: 20.96 C; Humedad del suelo: 72.00%; Temperatura del suelo: 20.67 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.96 C; Humedad del suelo: 72.00%; Temperatura del suelo: 17.22 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.96 C; Humedad del suelo: 72.00%; Temperatura del suelo: 21.77 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.49 C; Humedad del suelo: 72.00%; Temperatura del suelo: 33.80 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.96 C; Humedad del suelo: 72.00%; Temperatura del suelo: 22.57 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.49 C; Humedad del suelo: 72.00%; Temperatura del suelo: 16.11 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 19.55 C; Humedad del suelo: 72.00%; Temperatura del suelo: 24.88 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.02 C; Humedad del suelo: 72.00%; Temperatura del suelo: 16.53 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.49 C; Humedad del suelo: 72.00%; Temperatura del suelo: 31.83 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.49 C; Humedad del suelo: 72.00%; Temperatura del suelo: 32.86 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.49 C; Humedad del suelo: 72.00%; Temperatura del suelo: 25.53 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.49 C; Humedad del suelo: 72.00%; Temperatura del suelo: 18.76 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 20.49 C; Humedad del suelo: 72.00%; Temperatura del suelo: 29.23 C
Sensor data logged successfully!
Data received: Sensor ID: 1; Temperatura ambiente: 21.43 C; Humedad del suelo: 72.00%; Temperatura del suelo: 30.74 C
```

Accounts

0xe1b589b10e932ee81fb3...e642772e8a93bc7343a2f64

IOTA Balance

69.1239412

Net worth in USD

22.597

Net worth in IOTA

69.124

Portfolio

Activity

Transaction Blocks

Staking

All

Events

<<

<

>

>>

Show

10

>

Type	Activity Details	Activity With	Gas Fee	Age
<div>log_sensor_data</div> <div>9STMY4pB...AjmK7U21</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 8m
<div>log_sensor_data</div> <div>3hXVvsZf...DsQRpXbA</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 9m
<div>log_sensor_data</div> <div>Dc2UvCrK...Zq48ySds</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 10m
<div>log_sensor_data</div> <div>6FUmsMbQ...n4kM1tMh</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 11m
<div>log_sensor_data</div> <div>Aonw2i4Y...xXtnDYTY</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 12m
<div>log_sensor_data</div> <div>9tAVnVHG...xPfhAjQ1</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 13m
<div>log_sensor_data</div> <div>2BCrk9Bx...dPjwdUu2</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 14m
<div>log_sensor_data</div> <div>2EYhHwk7...88MmQ75P</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 15m
<div>log_sensor_data</div> <div>HkhyAerJ...hMBUVQpd</div>	-	<div>0xb8f5a3...acb29acc</div>	0.001 IOTA 1,000,000 NANO	1h 16m



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Thanks for you Attention!

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