



Explainable Federated Deep Learning Models on Digital Twins for Smart Agriculture

Framed by : Phd. Hella Kaffel

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PLAN

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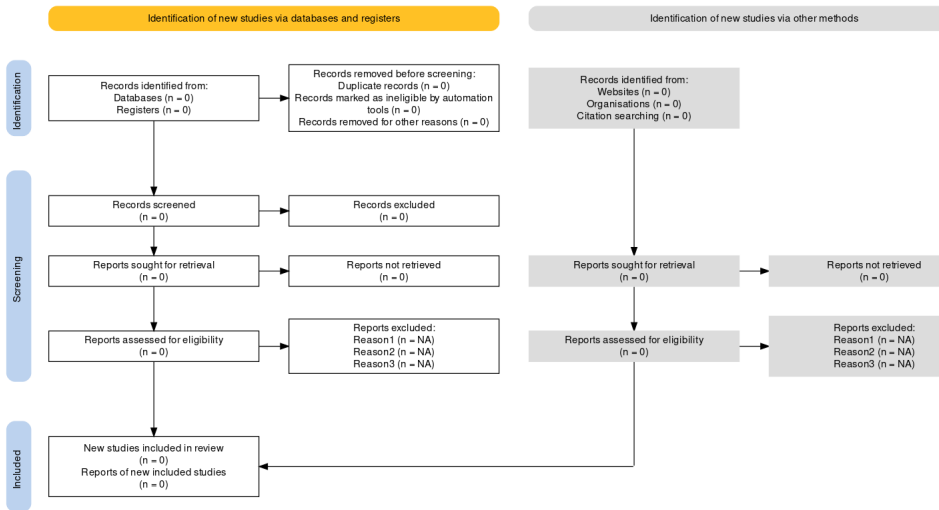
Definitions

Methodology in research selection

- A systematic literature search is based on the PRISMA method
- Covering most of the peer-reviewed interdisciplinary research papers
- Articles collected were further refined through a the 4 steps of which are detailed in the flow chart, as depicted in figure:

Definitions

Methodology in research selection



Definitions

Definitions

Definition

A digital twin is defined as a virtual representation of a physical asset enabled through data and simulators for real-time prediction, monitoring, control and optimization of the asset for improved decision making throughout the life cycle of the asset.

Definitions	Key word
A digital twin is a virtual representation of a physical product or process, used to understand and predict the physical counterpart's performance characteristics. Digital twins are used throughout the product lifecycle to simulate, predict, and optimize the product and production system before investing in physical prototypes and assets.	Digital Twin, Virtual model
The DT is a set of virtual information that fully describes a potential or actual physical production from the micro atomic level to the macro geometrical level. At its optimum, any information that could be inspected from a physical manufactured product can be obtained from its DT	Digital Twin, Cyber Physical Systems (CPS)
Faster optimization algorithms, increased computer power and amount of available data, can leverage the area of simulation toward real-time control and optimization of products and production systems – a concept often referred to as a Digital Twin	Simulation, Computerized
digital twin is an integrated multi-physics, multi-scale, probabilistic simulation of a complex product and uses the best available physical models, sensor updates, etc., to mirror the life of its corresponding twin	Digital twin, Product lifecycle Design, Manufacturing, Service, Big data, Cyber and physical convergence
An integrated multiphysics, multiscale, probabilistic simulation of an as-built system, enabled by digital thread, that uses the best available models, sensor information, and input data to mirror and predict activities/performance over the life of its corresponding physical twin	Integrated System
the Digital Twin itself refers to a comprehensive physical and functional description together with all available operational data of a component, product or system, which includes more or less all information which could be useful in all the current and subsequent - lifecycle phases	Digital Twin, operation assistance, simulation, mechatronics, cyber-physical system

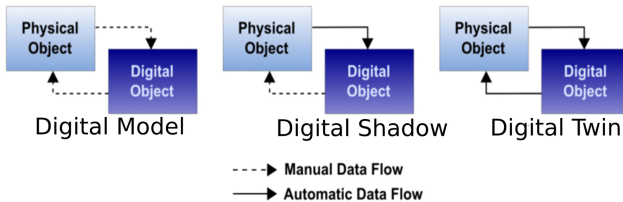
Type of Digital twin

Digital Model: In this type of DT, the data between the physical and digital object are exchanged manually, due to which any changes in the state of the physical object are not reflected in the digital one directly, and vice versa.

Digital Shadow: The data from the physical object flow to the digital automatically, but this is still manual the other way around. As a result, any change in the physical object can be seen in its digital copy, but not vice versa.

Digital Twin: In this type of DT, there is an automatic bidirectional flow of data between the physical and digital object. Therefore, the changes in either object, physical or digital, directly lead to changes in the other.

Type of Digital twin



DTs Architectures

Step 1

The physical IoT network interacts with the connectivity layer where Eclipse Hono.

Step 2

This latter simplified IoT for each supported protocol (HTTP, MQTT or CoaP) used the API.

Step 3

Eclipse Hono communicates with the digital layer using Advanced Message Protocol (AMQP).

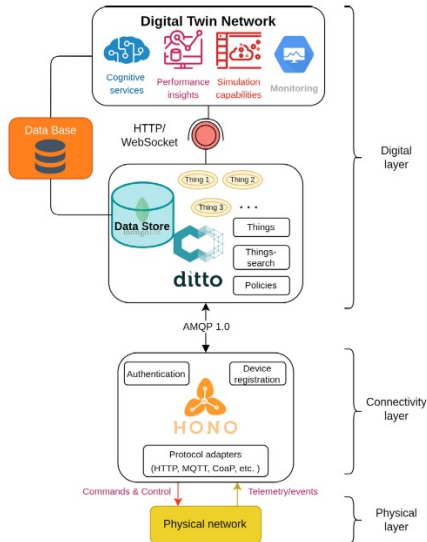
Step 4

Eclipse Ditto structures the data sent by devices via Hono into digital IoT Twins (represented as a thing).

Step 5

The DTN interacts with Ditto via this HTTP API or a WebSocket.

DTs Architectures



Thank you for your attention.