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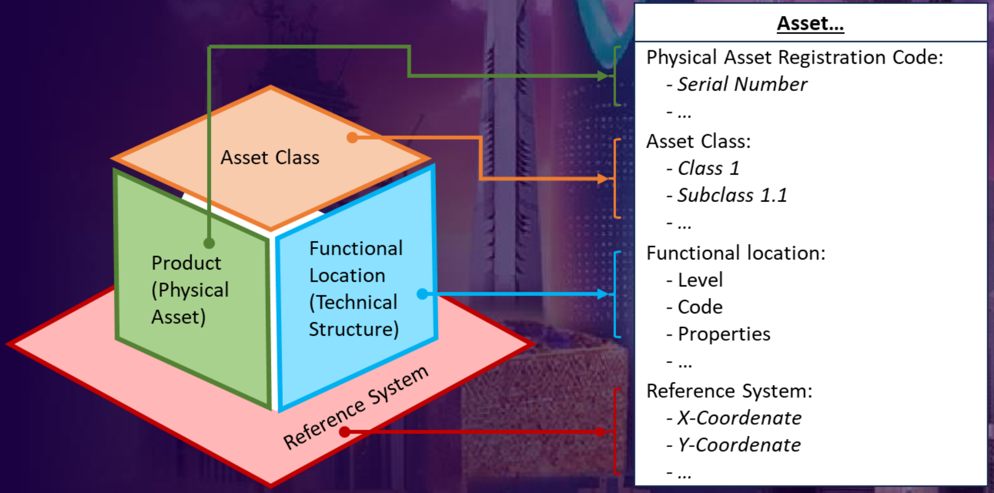
المؤتمر الدولي الثاني والعشرون لإدارة الأصول والمرافق والصيانة
The 22nd International Asset, Facility & Maintenance Management Conference

Digitization - Excellence - Sustainability

S-01: DIGITALIZATION MODEL AND ASSET HEALTH MANAGEMENT

By Prof. Adolfo Crespo Márquez



26-28 January 2025
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S-01: DIGITALIZATION MODEL AND ASSET HEALTH MANAGEMENT

1 Introduction & Background

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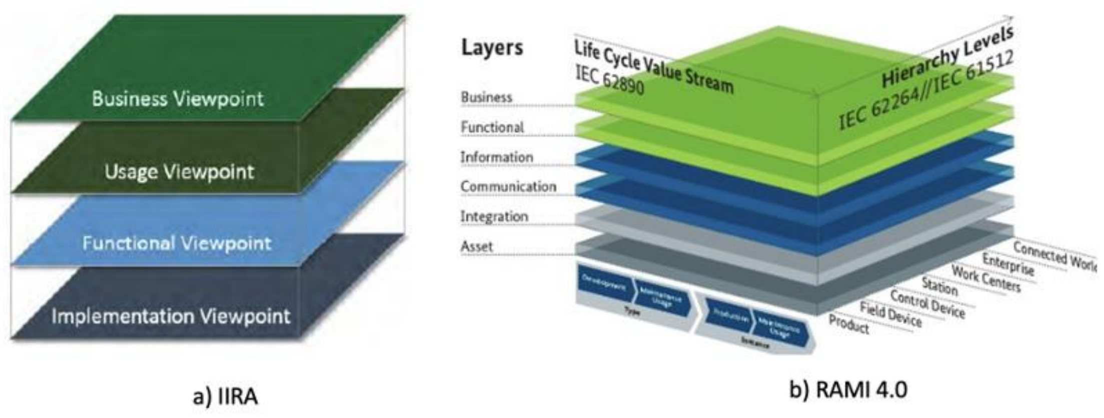
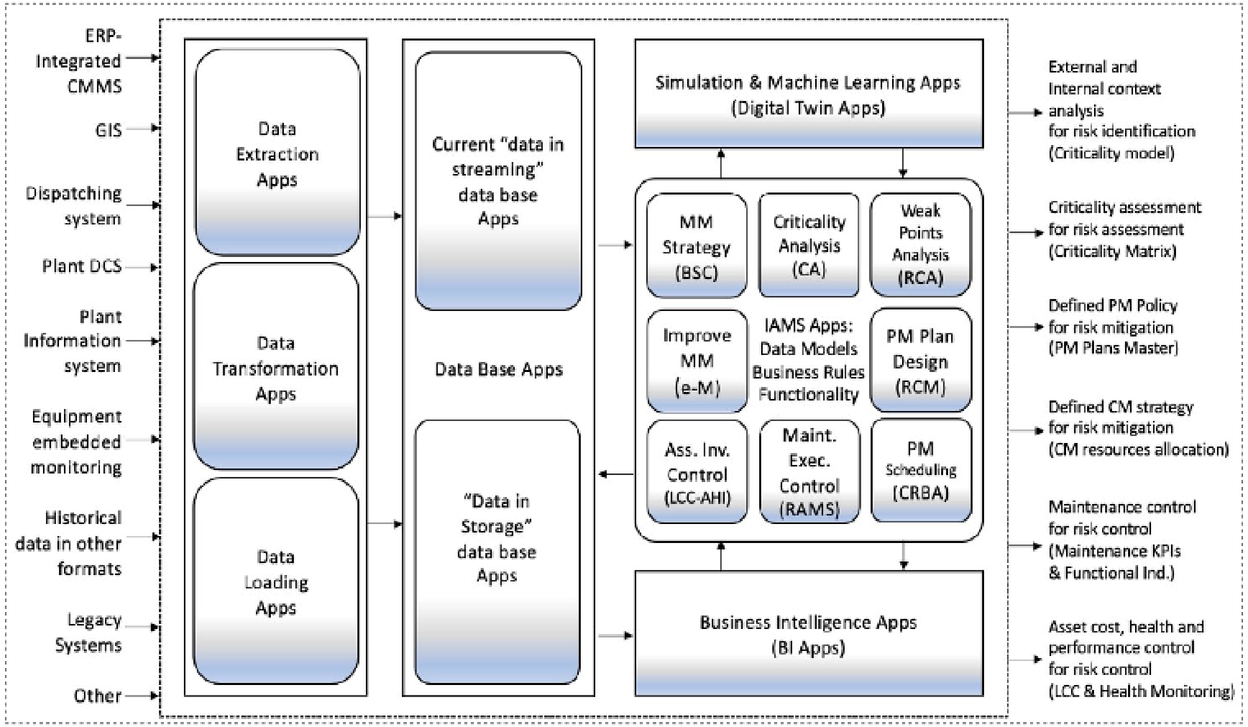
INTRODUCTION AND BACKGROUND

The digitalization of assets requires a technical design within a designated IT architecture for integrating different systems and platforms



Layered reference architectures a)IIRA & b) RAMI 4.0

Digital Maintenance Management (DMM) requires a framework to integrate models in intelligent Apps throughout various phases of the comprehensive MM process. This representation involves transforming raw data from diverse business systems into specific data bases feeding models in Apps for various aspects of asset management process digitalization.



A digital maintenance management framework proposed by Crespo, A. (2022)

INTRODUCTION AND BACKGROUND

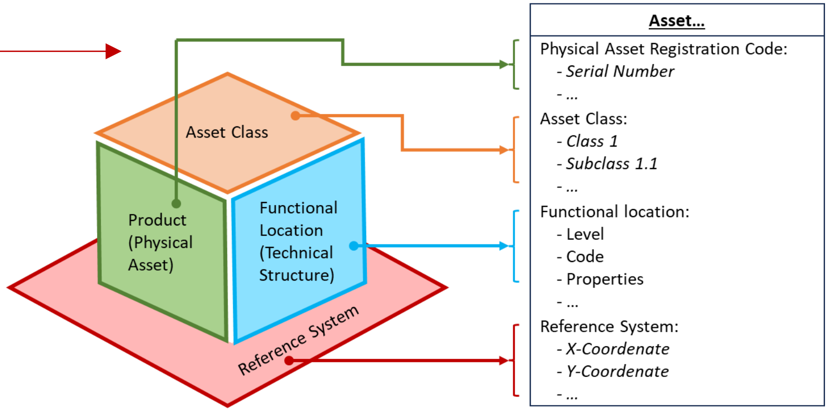
1. How can a model-based approach for asset digitalization be effectively introduced to serve maintenance and asset management purposes?

2. In what manner can this approach be integrated with digital maintenance decision-making processes?

3. How can the combined use of an IoT monitoring platform with short-term models, such as CBM models, and long-term models, such as AHI, be applied to enhance asset digitalization and management?

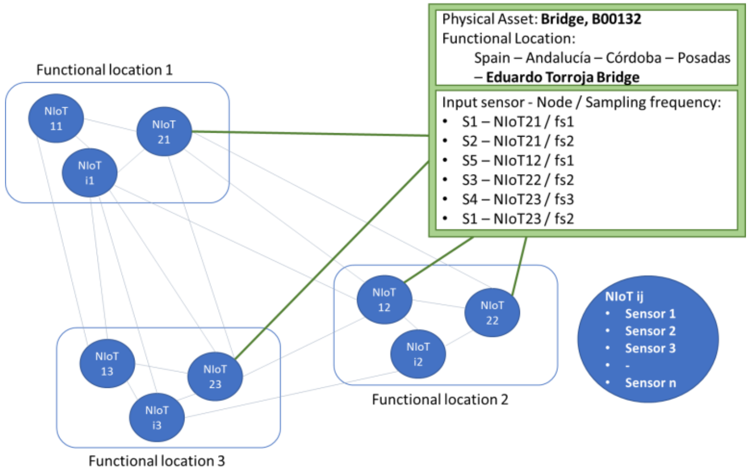
DATA MODELS FOR ASSET DIGITALIZATION

1. The Asset Definition Model
   - Describes the comprehensive asset data/information which is implicitly present within the diverse information systems and apps currently utilized for the asset management.



2. The Asset Criticality Model
   - This model enables the prioritization of assets, organizing them from highest to lowest criticality and importance within the organization.

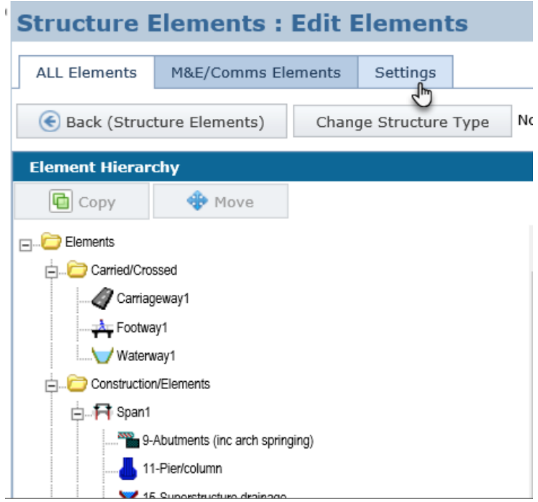
3. The Asset Monitoring Model
   - Involves signal integration and the establishment of a comprehensive Extract, Transform, Load (ETL) process, facilitating the conversion of signals into valuable asset-related information.



4. The Intelligent Asselt Management Model
   - These models are selected for the specific management of a given asset.

- ❖ Root Cause Analysis (RCA)
- ❖ Reliability-Centered Maintenance (RCM) or Maintenance Task Analysis (MTA)
- ❖ Condition Based Maintenance (CBM)
- ❖ Maintenance Resources Optimization models (MRO)
- ❖ Reliability, Availability, Maintainability and Safety Analysis (RAMS)
- ❖ Asset Health Indexing (AHI) & Life Cycle Costing (LCC)

Case Study: Bridge Definition



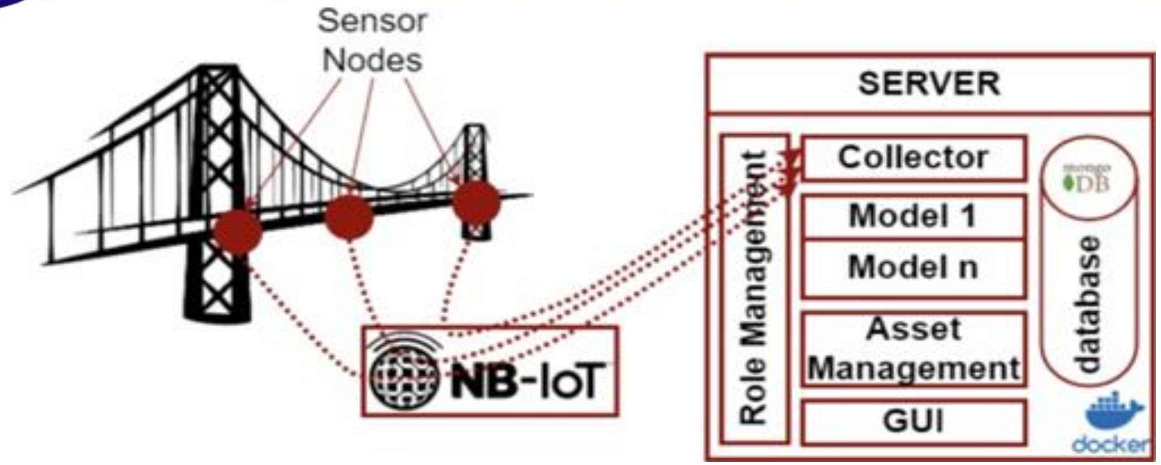
Data type	Description	Platform	Superstructure
Functional location data	Distant to the coast Altitude Average outdoor temperature Corrosive atmosphere Dust in suspension	160 km 86 m 22.5°C No No	160 km 86 m 22.5°C No No
O&M Cost data	Corrective maintenance cost	10,000€	20,000€
	Preventive maintenance cost	3,000€	2,000€
	Other operational costs	1,000€	1,000€
	Major maintenance cost	60,000€	100,000€

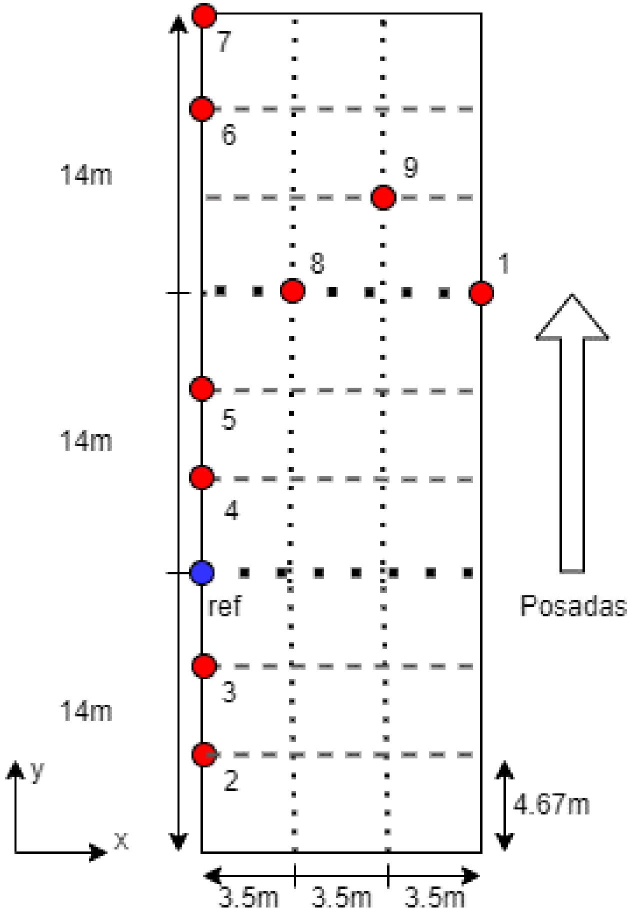
The focus of this analysis centers on the Eduardo Torroja Bridge, situated south of Posadas, Córdoba, spanning the Guadalquivir River.

With its inauguration dating back to 1951, the bridge boasts specific dimensions, including a length of 235 meters, a width of 11 meters, seven cement pillars, and a distinctive appearance featuring eight eyes or inverted bristles supporting the deck.

In the context of this analysis, the methodology will be exclusively employed for the components of the roadway surface and superstructure. The pertinent data related to the functional location and O&M cost of these specific components are documented and outlined in this Table.

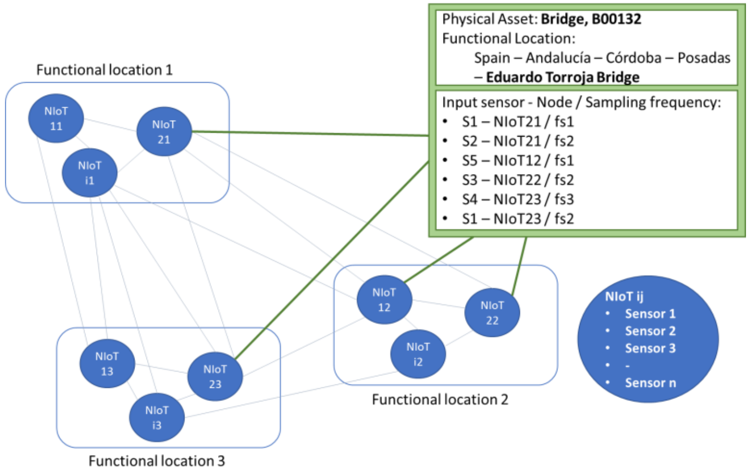
Case Study: Bridge Monitoring model



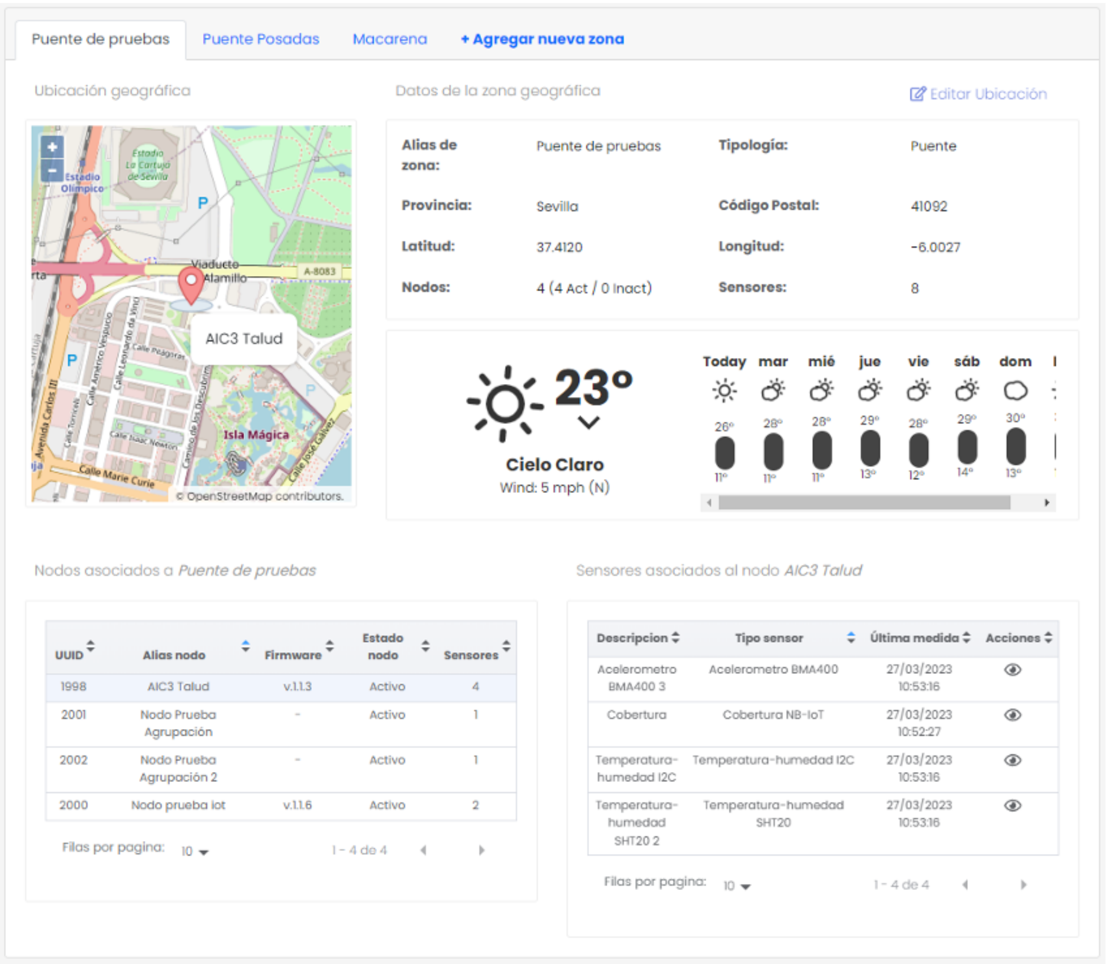


To digitize the asset's condition monitoring, it is imperative to establish integration with information sourced from the IoT/Cloud network strategically positioned at various points across the bridge.
Highlighting specific locations in a roadway section measuring 42 meters in length and 10.5 meters in width.
These nodes serve the dual purpose of capturing information from the bridge and offering data not only exclusive to the roadway due to their location but also insights regarding the condition of other bridge components.

Case Study: Bridge Monitoring model

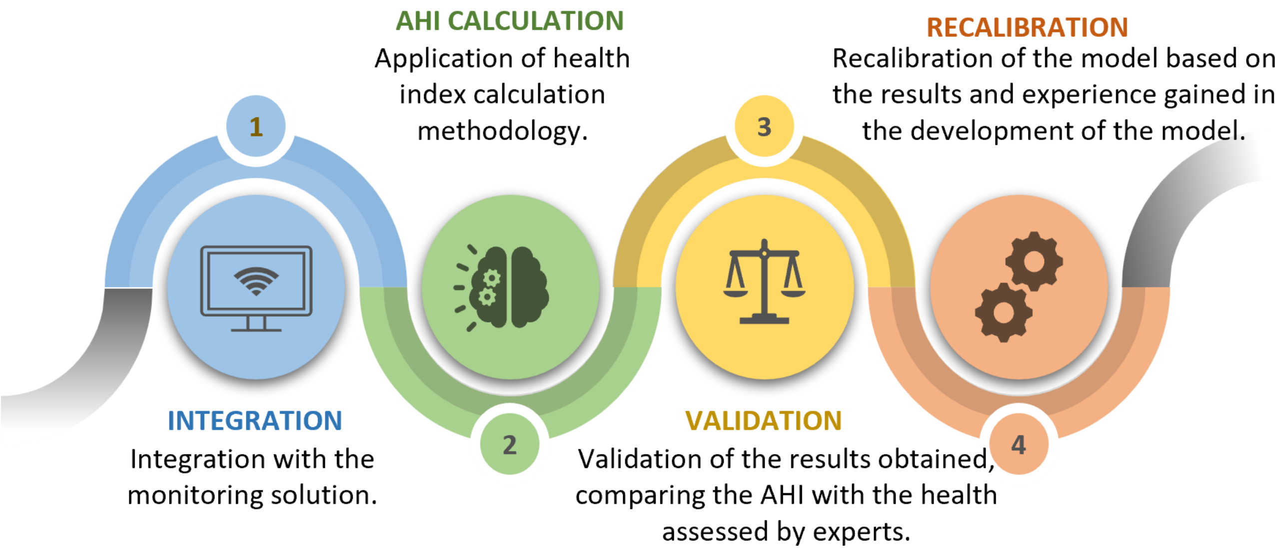


Some assets lack connectivity. NBIoT offers a cost-effective, long-range solution, ideal for low-power devices. Despite being slow with high latency, its capacity and security make it suitable for quick, affordable deployment.



IoT platform caption of information about bridge location, nodes and sensors

Case Study: Bridge Health Index Model



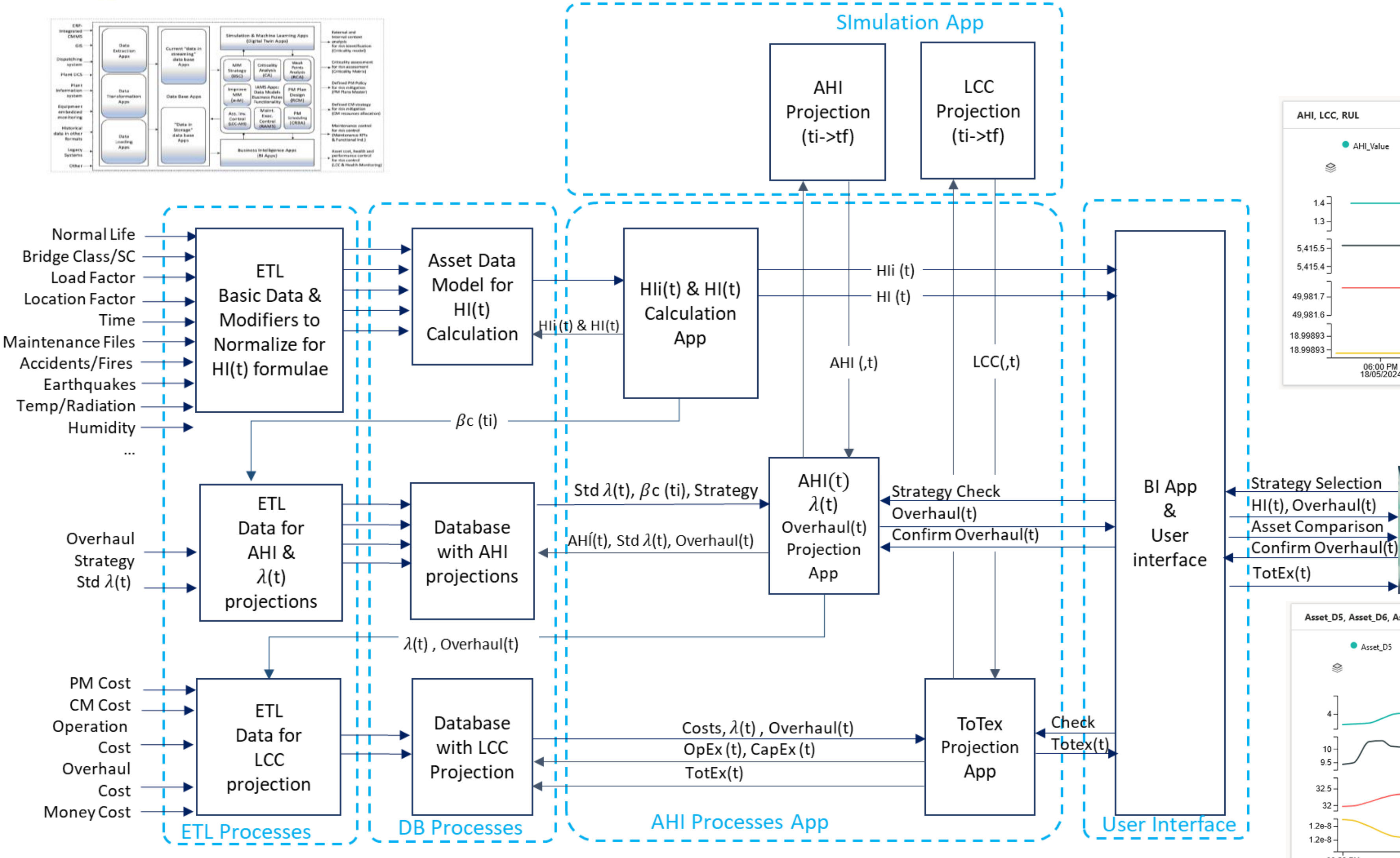
An asset health index model was used, that was integrated with the platform.
The IoT platform provides data extraction, processing, and loading (ETL processes), which provide inputs for databases needed by the AHÍ model to:

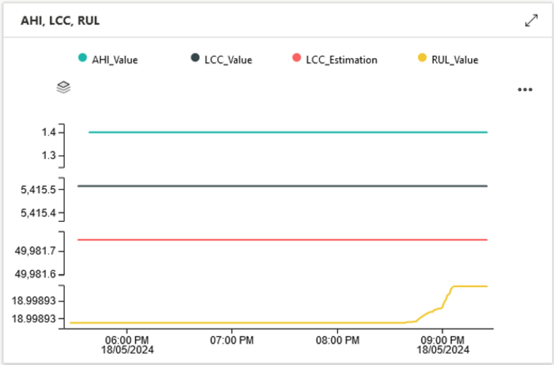
1. Calculate the asset health index and assess its impact using various factors (asset class, location, load, age, maintenance, sensors, etc.).

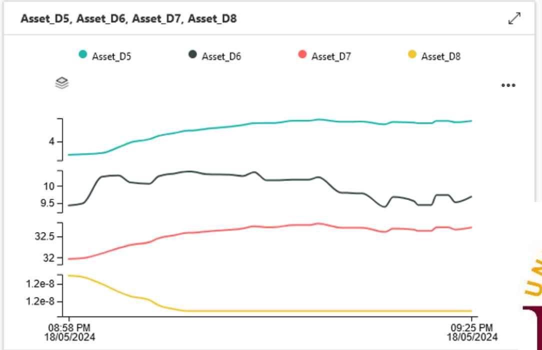
2. Update and correct the aging rate over time to project health index and failure frequency, considering maintenance strategies and standard failure rates.

3. Estimate lifecycle cost profiles, accounting for different maintenance operations (preventive, corrective, and major maintenance).

Case Study: Bridge Health Index Model







Conclussions

- This study addresses the critical aspects of maintenance digitization, recognizing the current gap in effective implementation despite the technological advancements in IoT platforms and digital twins..

- The practical aspects of maintenance management take center stage in the framework, highlighting the need to integrate advanced digitization solutions with a focus on IoT platforms and digital twins.

- As a use case in the study, a notable contribution of this study is the consideration of an asset health index model, addressing the limitation of many IoT/cloud networks that primarily focus on short-term decisions.

- This model connects real-time monitoring with medium and long-term planning, including End-of-Life (EOL) management. The strategic integration of the asset health model emerges as an interesting component in digitization, facilitating knowledge management within advanced asset digitization models.

- In summary, this study provides a framework for effective maintenance digitization, emphasizing practical implementation, model-based perspectives, and the strategic integration of an asset health index model, ultimately contributing to the advancement of digitization practices in the field of maintenance management

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