Hes·so
Ingénierie et Architecture

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OAK - ONBOARDING WITH ACTIONABLE KNOWLEDGE

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PROJECT SUMMARY

Problem

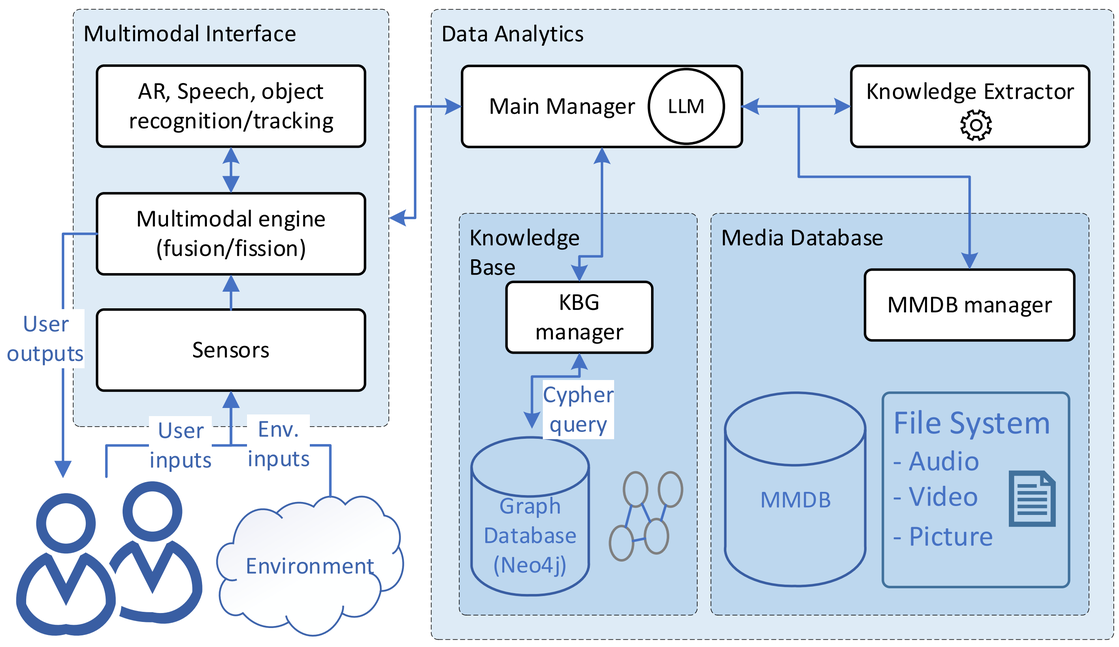
The industry is facing a loss of knowledge due to the departure of experienced operators and generational imbalances in the workforce. Traditional internal training is costly, difficult to standardize, and does not effectively meet needs.

Proposed Solution

- **Knowledge base** to store operational skills experience.
    - Knowledge Graph
    - Knowledge Graph Embedding[1] and similarity search
- **Multimodal interface** (Tutor) to record the know-how of experienced operators and make operational skills easily accessible
    - User-centered design
    - Augmented reality

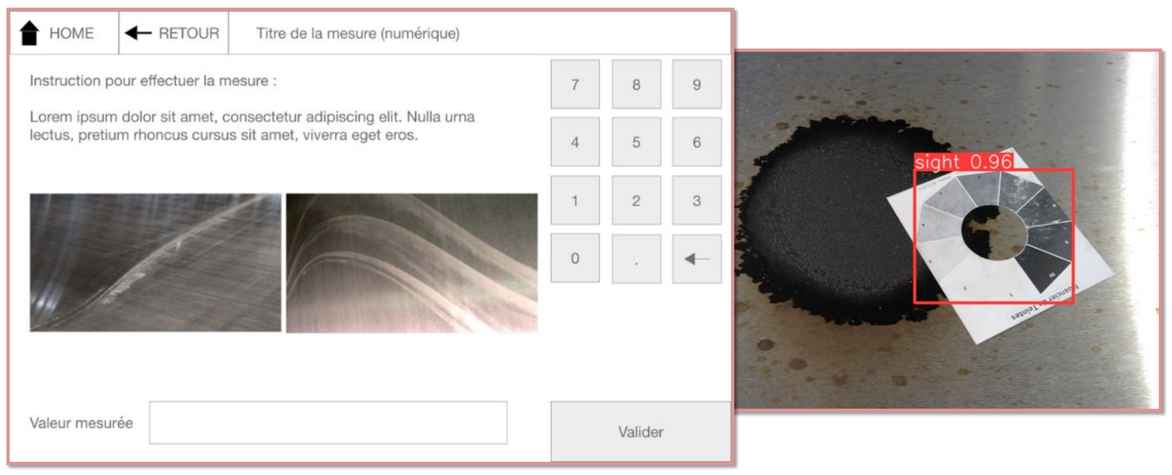
METHODS

- **Data Analytics**
    - Knowledge base – Graph database (*Neo4j* [2])
    - Knowledge graph embedding and extraction (*Rebel*[3])
    - Object recognition and tracking in real-time (*Yolo*[4])
- **Multimodal interface**
    - User-centered design
    - Mobile device adapted to the shop floor
        - Record know-how
        - Search and navigate know-how
    - Multimedia DB: (text, audio and video) as inputs/outputs



RESULTS

- Focus on a real-world application:): quality control of high-precision aluminum plate manufacturing
- Development of a Proof-Of-Concept (novice operator point of view):
    1. The operator scans the ID of the plate where a *possible* defect is spotted
    2. The operator describes the defects (text, audio and/or video)
    3. The system returns a list of the most probable defects
    4. The system guides the operator through the steps to measure the gravity of the defect
        a. Textual, audio and/or video instructions
        b. Some measurements are supported by specific, integrated AR applications
    5. The operator logs the measured value in the system (optionally providing pictures or videos).
    6. The operators takes the decision concerning the conformity of the plate: continue production, discard it, or require additional review from a supervisor.



NEXT STEPS

Usability study (Multimodal interface)

- Augmented reality
- Object tracking

Approaches and models comparison (Data analytics)

- Relevance
- Computational resources
- Data security
- Multilanguage

RÉFÉRENCES

1. J. Cao, J. Fang, Z. Meng, and S. Liang, “Knowledge Graph Embedding: A Survey from the Perspective of Representation Spaces.” arXiv, Nov. 07, 2022.
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4. J. Terven and D. Cordova-Esparza, “A Comprehensive Review of YOLO: From YOLOv1 and Beyond.” 2023

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