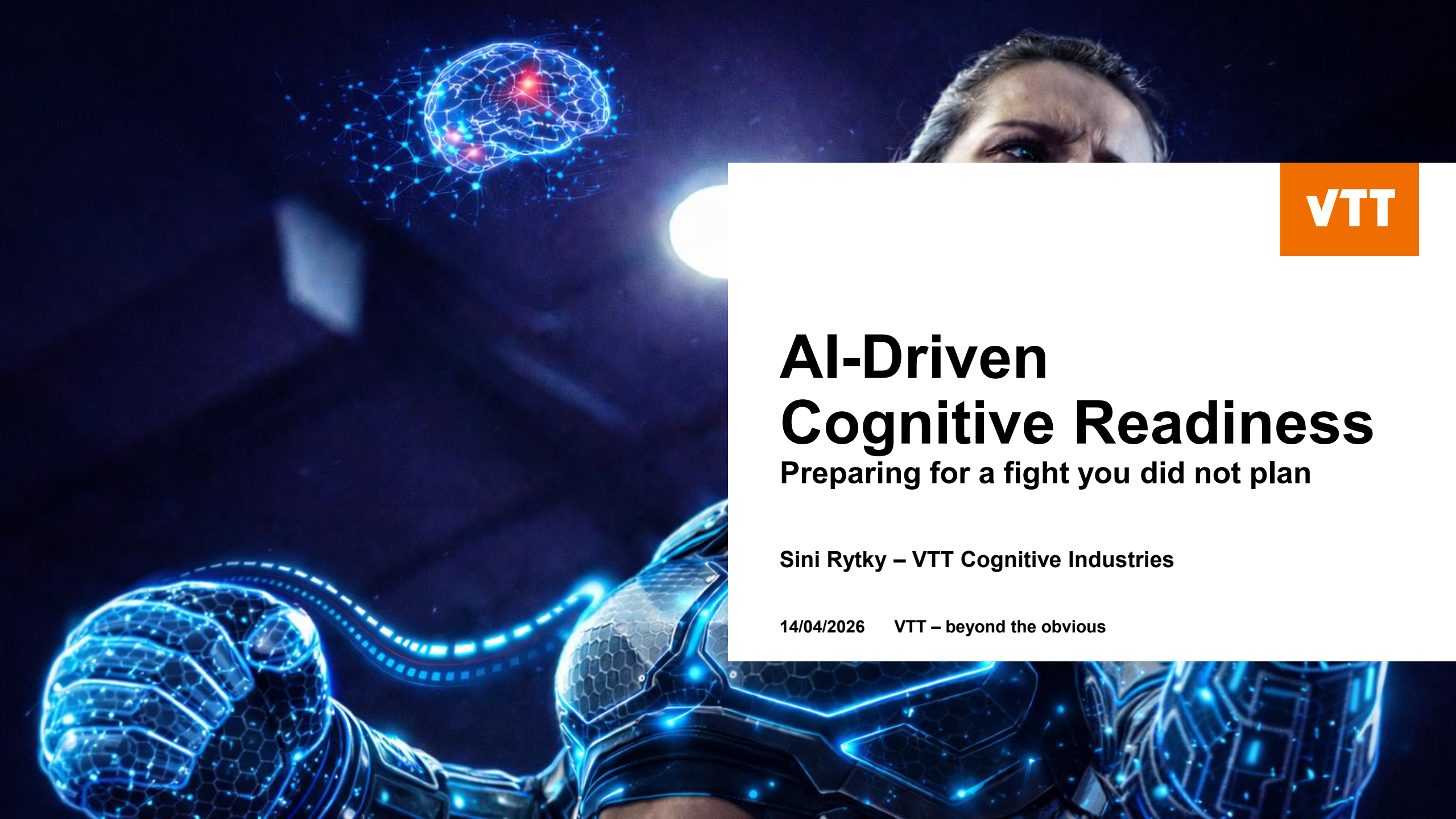


AI-Driven Cognitive Readiness

Preparing for a fight you did not plan

Sini Rytky – VTT Cognitive Industries

14/04/2026 **VTT – beyond the obvious**

Across industries, the challenge is no longer optimization, but operating under unknown unknowns

- Geopolitical instability shapes investments
- Technologies evolve faster than raw data
- Future team structure includes humans, robots and AI

Cognitive Readiness:

The ability of humans, robots and systems to make best possible decisions when the pre-programmed reality is no longer a choice.

Our Competences for Cognitive Readiness

HUMAN FACTORS

We study how humans think, decide, and adapt translating that understanding into adaptive training environments and situational awareness systems that enhance human perception, decision-making skills, and coordinated action.

PERCEPTION

- Computer vision, sensor fusion
- ERP, MES, process data
- Localization and GPS-free navigation
- Synthetic data for AI/ML training
- Edge computing

LEARNING

- Supervised & semi-supervised learning, neural networks
- MLLMs, LLMs, VLMs, multimodal foundation models
- Time series, behavioral analytics and knowledge capture

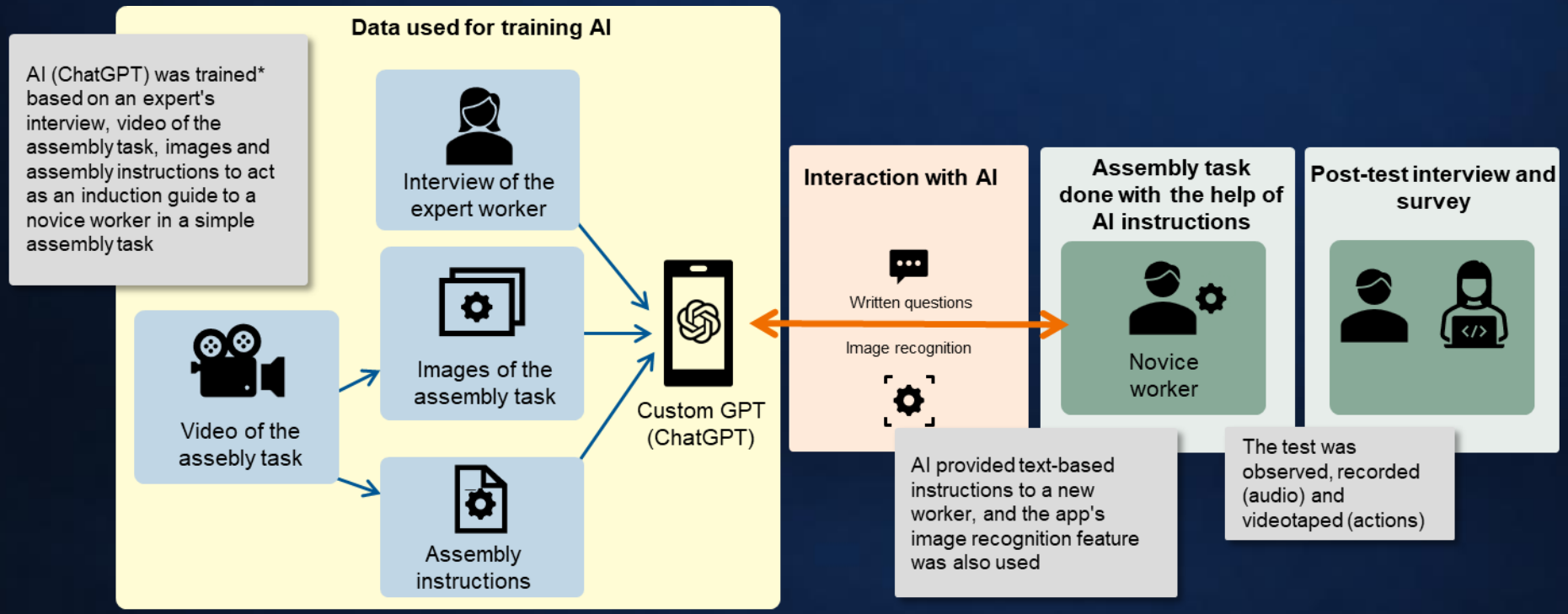
ACTION

- XR interfaces and immersive operational twins
- Agentic AI for real-time decision support
- Robotic and process level task automation

Our Competences for Cognitive Readiness

We train humans, robots and AI systems, and support their performance in complex, dynamic real-time operations.

Training **Humans** for Cognitive Readiness: AI Assistants for Industrial Work



**The data was not used to develop LLM*

Read more: www.hifive.fi

Training **Humans** for Cognitive Readiness: AI Assistants for Industrial Work

Overview

- Novices successfully assembled the part with AI guidance (some used AI more than others)
- Experts confirmed the process flow was correct but noted missing details (e.g., bearing steps)
- Instructions were deemed overall correct with minor errors/inconsistencies
  - Sometimes skipped details (e.g., alignment gaps, bearings)
  - Accuracy improved with precise questioning

Advantages

- Supports instructions by giving tips, clear language and structure
  - User can ask for clarification and follow-up questions
- **Simple to use** (familiar device, everything one or two clicks away)
  - Step-by-step instructions easy to follow after brief familiarization
- **Makes tacit knowledge explicit**

Quotes:

- *"Once I figured out how to use it, it became easier to ask questions." (H1)*
- *"It would be good for something you don't do often." (H3)*
- *"I knew that, but it's rare that someone actually says it." (H3)*

Disadvantages

- Lack of experiential knowledge → AI cannot replicate the *"feel"* of manual work
- Required learning how to "ask correctly"
- Sometimes failed to detect errors
  - Does not always recognize problems from images (limited background data)
  - Cannot retrieve images from background data

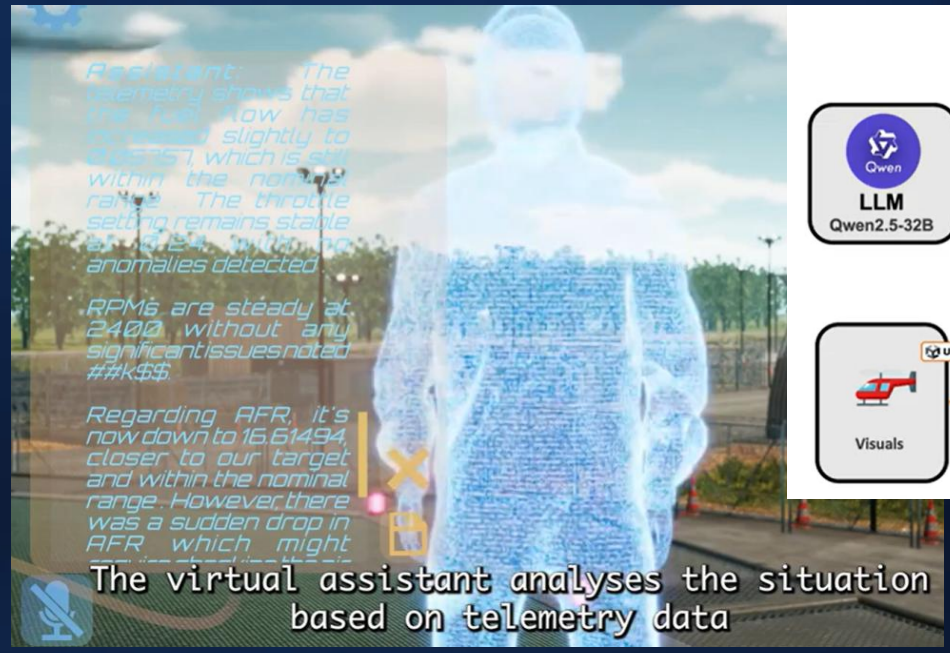
Quotes:

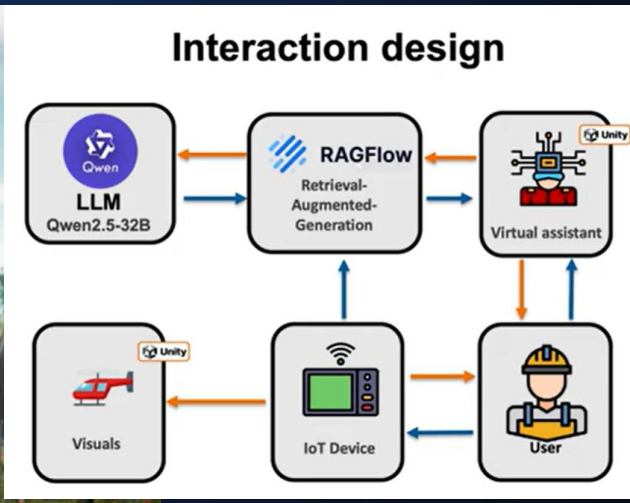
- *"You learn by watching and feeling and this doesn't give you that." (H4)*
- *"It's faster, but you don't chat like with coworkers." (H5)*
- *"If you just grind away by yourself, it kills you." (H2)*

Development

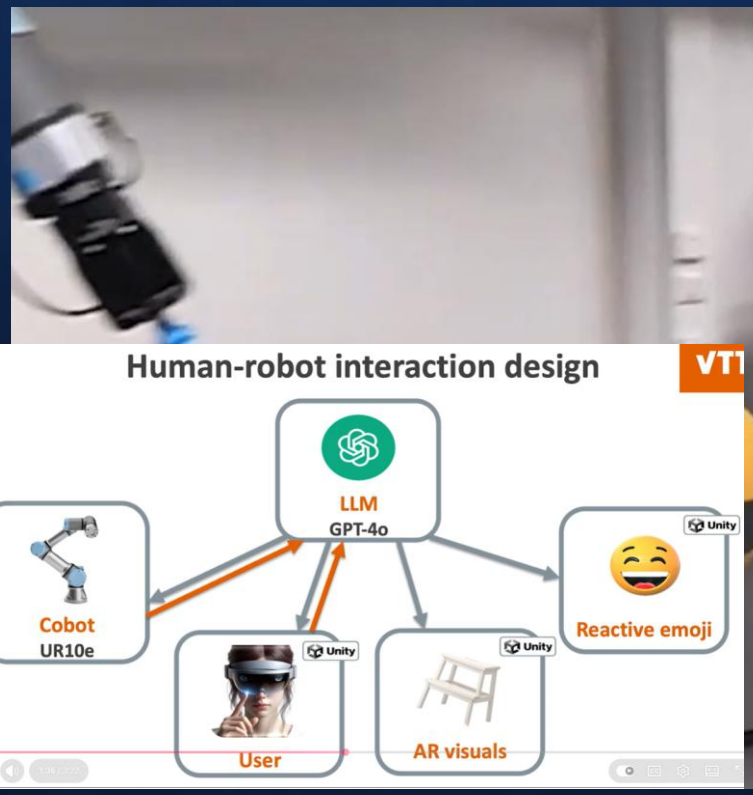
- Instructional completeness: refine instructions, terminology and phrasing
- **Visual feedback**: include photos, videos, or 3D exploded views
- Potential for in-demand support and information retrieval (no clear benefit for familiar tasks)
- Interface**:** tablet or mounted display preferred; easy access (no logins)
- Integration**:** link with existing systems
  - Should be simple to use ("*Pim-pim-pim, done.*")
  - Must be designed with end-user in mind

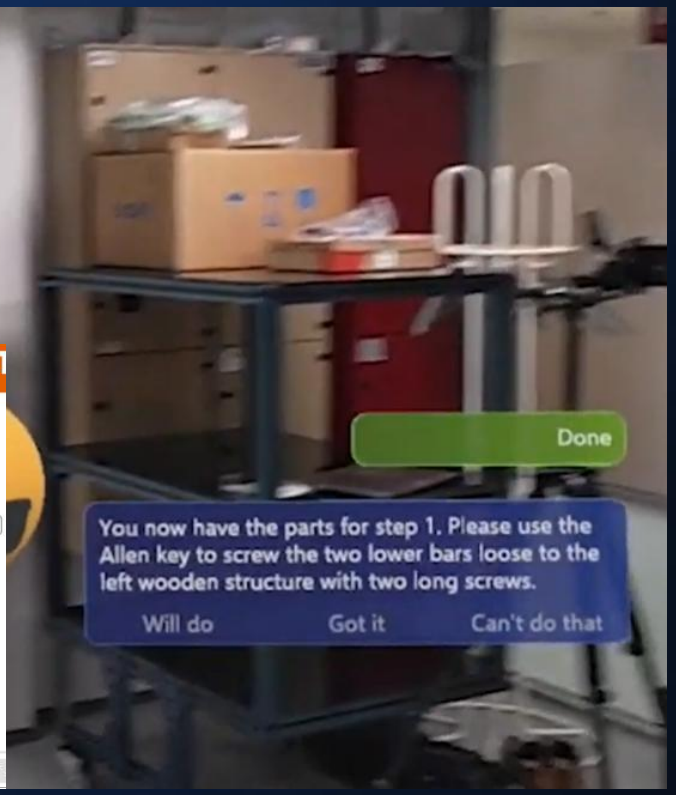
Training **Humans** for Cognitive Readiness: AI Assistants for High-Complexity Remote Maintenance





Training **Robots** for Cognitive Readiness: LLMs for robot control – Human – AI – Robot team





Training **Systems** for Cognitive Readiness: Synthetic Data for Aviation Security

"IWTSD being the official contracting organization, has been pleased with the collaboration with VTT and strong expertise and efficiency in execution. TSA and TSL have found the collaboration throughout the project well organized leading to a valuable collaboration. All parties have a strong belief in game changing nature of synthetic data and hope to work together in this field going forward."

SIG Project Stakeholders IWTSD, DfT, TSA and TSL

Training **Systems** for Cognitive Readiness: Synthetic Data for Aviation Security – Initial Problem

- In defense and security, development of AI capabilities is critical but extremely challenging due to the fast-paced development of wide range of sensors with varying basic operational principles
- AVSEC in modern airports is based on two types of security inspection devices: On-person millimeter wave (mmWave) screening (AIT) Luggage X-ray Computed Tomography screening (XCT)
- At the core of the security ist he Automatic Threat Recognition (ATR) algorithms detecting prohibited items and materials. Whenever a new threat emerges, algorithms must be re-trained.
- Poorly trained ATR algorithms cause high false positive alarms, which leads to extensive need for security personnel workforce.

Cross-domain, future-looking topics of interest for AI driven cognitive readiness solutions of the future

- Knowledge capture for skill transfer
- AI driven scenario planning for high stakes training
- Synthetic data

VTT

beyond

the obvious

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