

# PO.013

## Multi-Agentic Collective Intelligence with Generative AI for Interactive Decision Support in the Offshore Wind Industry

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### THE PROBLEM

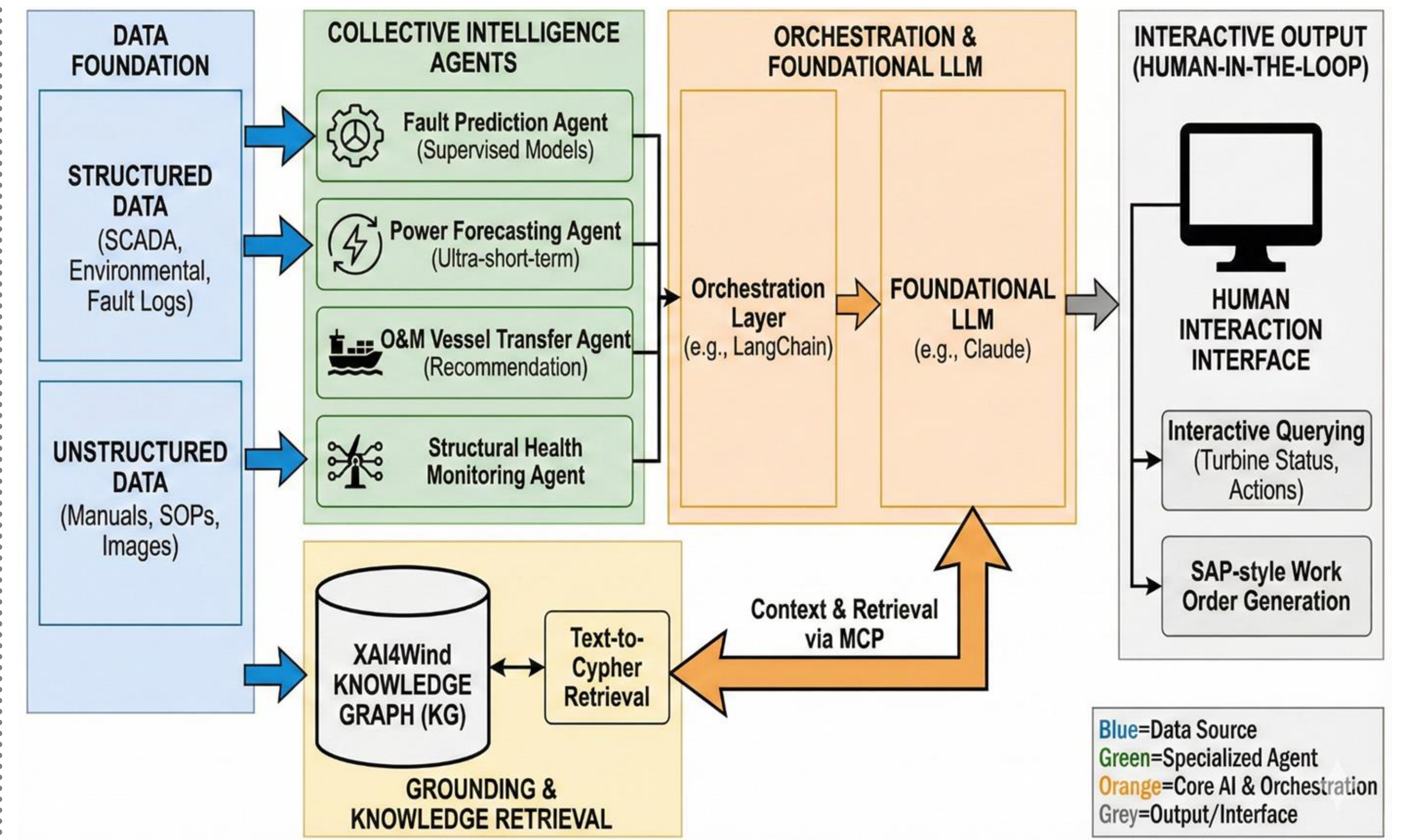
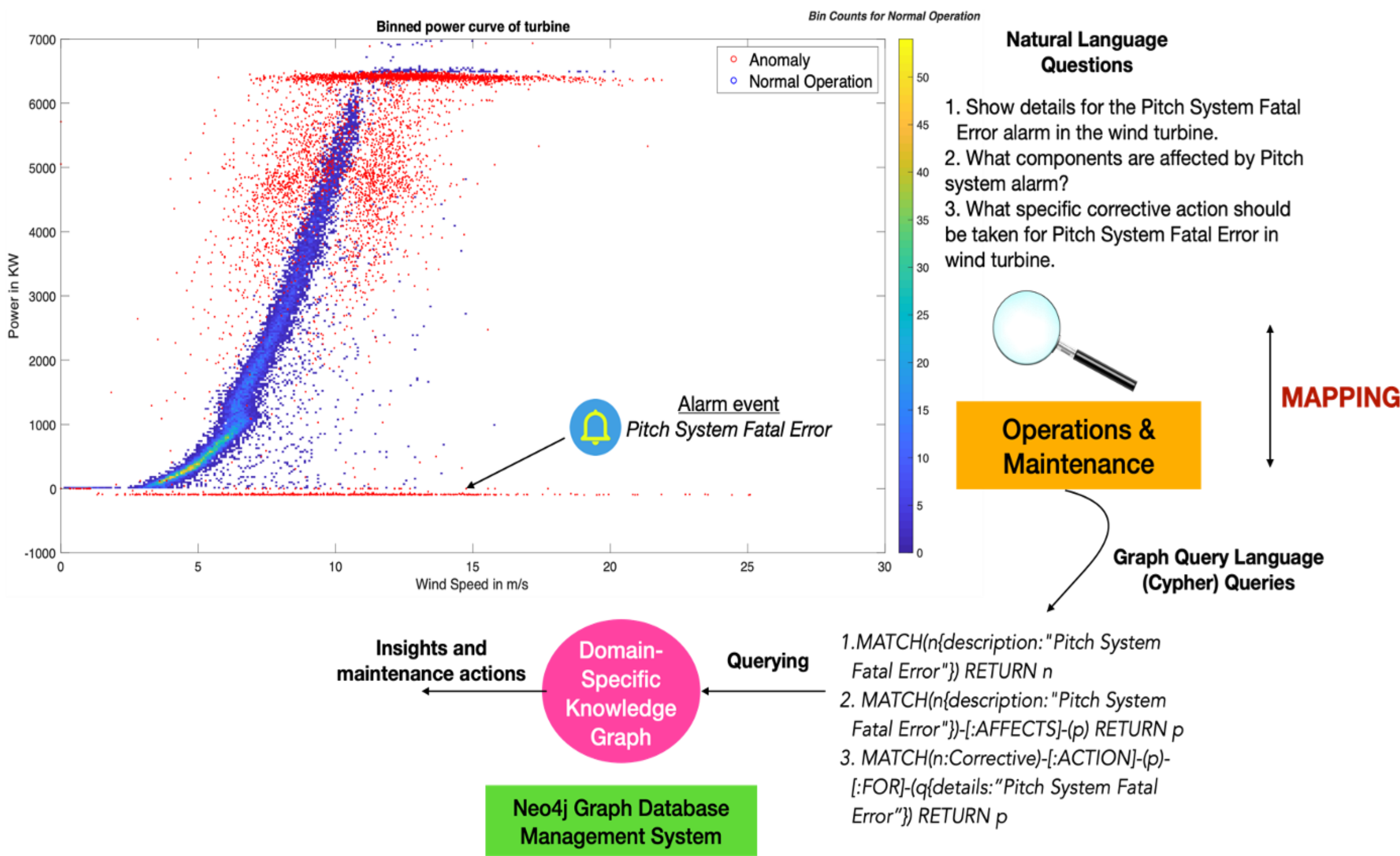
- Most AI models for wind turbine O&M presently operate in silos, failing to capture nuanced inter-dependencies (e.g., between power output, maintenance history, and blade health).
- Large Language Models (LLMs), whilst highly capable at information synthesis - often hallucinate and are unsafe for critical systems.

### PROPOSED SOLUTION

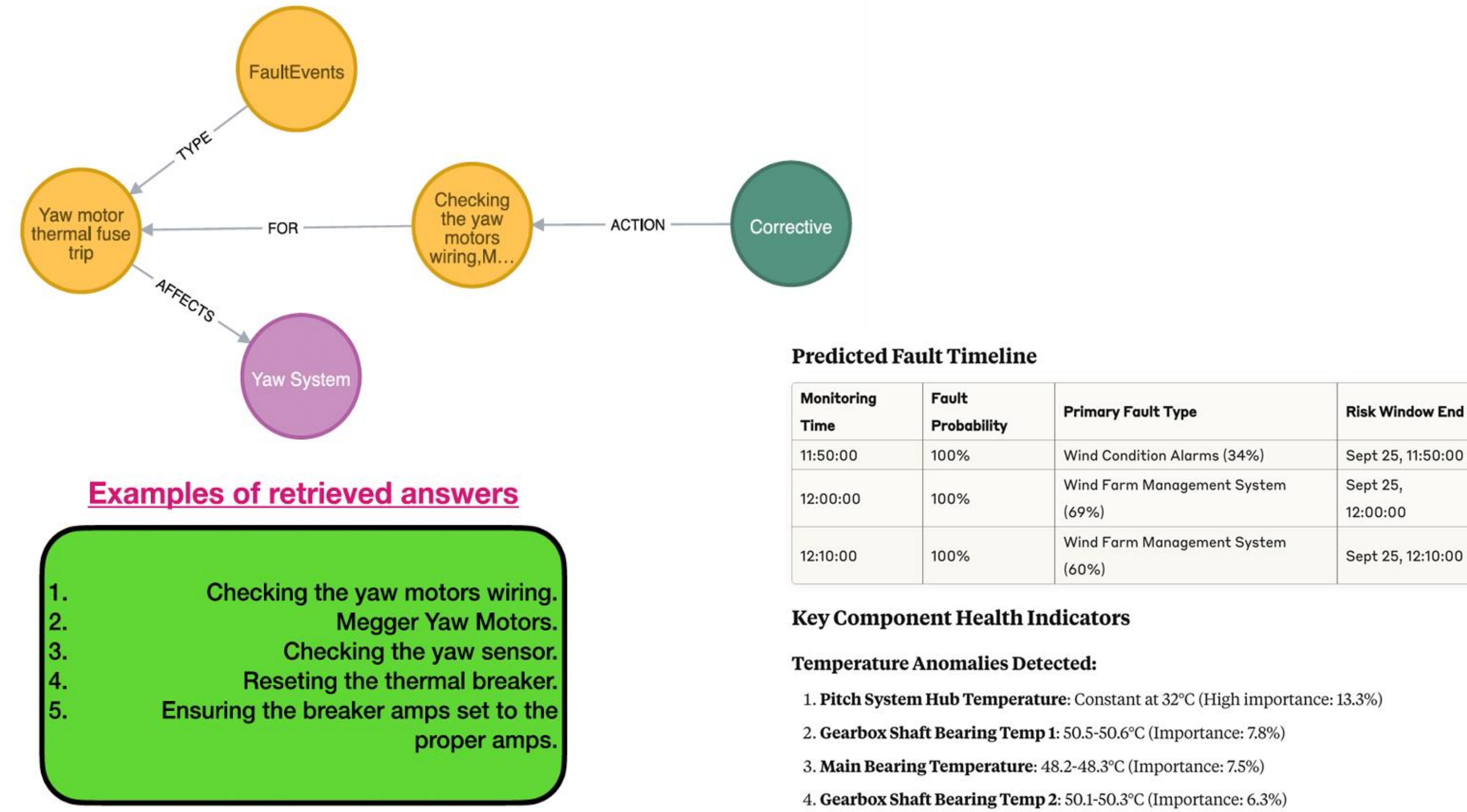
- Multi-Agent AI system grounded by Knowledge Graph (XAI4Wind).
- Prevents hallucinations through formal domain knowledge.

### KEY INNOVATION

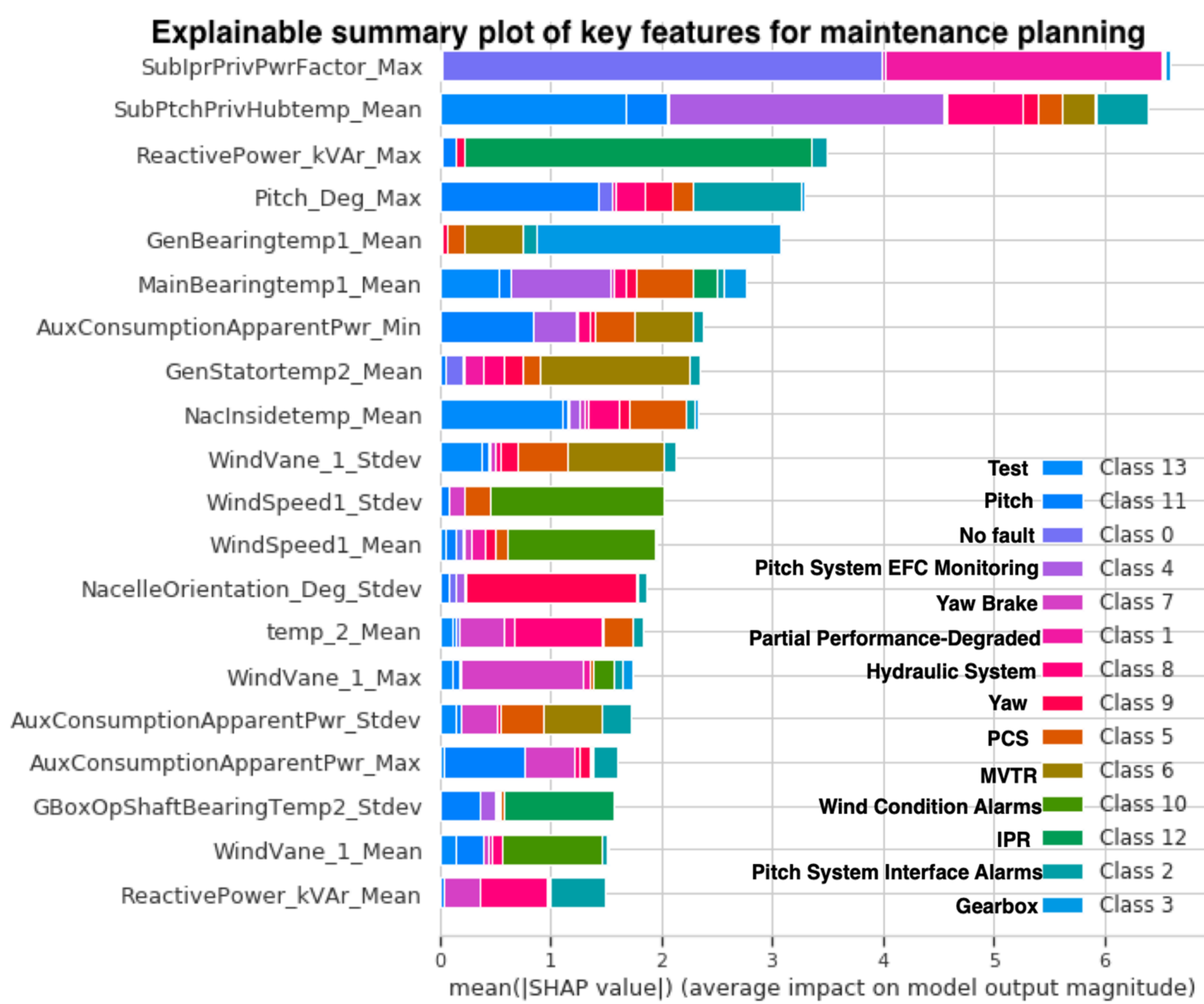
Collective Intelligence: Multiple specialized AI agents + Knowledge Graph = Reliable, transparent interactive decision support.



### CLAUDE MODEL CONTEXT PROTOCOL (MCP) – XAI4WIND INTEGRATION



### EXPLAINABLE AI FOR CONTEXTUALISING FAULTS FOR LLMs



\* Note that views and methodologies presented in the poster are those of the authors and do not represent EPAM Systems

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Now let me look for specific corrective action nodes that are related to the gearbox:

R read_neo4j_cypher

Request
{
  'query': `
// Find corrective action nodes that are FOR the gearbox
MATCH (corrAct)-[:FOR]->(gearbox:Gearbox)
WHERE corrAct.name STARTS WITH 'CorrAct'
RETURN corrAct.activities as activities, labels(corrAct) as node_type
    
```

### CONCLUSION

- **Holistic Framework:** Moved beyond isolated ML models to a Multi-Agentic Collective Intelligence system that captures whole-system dependencies.
- **Safe Automation:** Mitigated GenAI risks (hallucination) by grounding outputs against the formal XAI4Wind Knowledge Graph.
- **Operational Impact:** demonstrated ability to optimize maintenance schedules and offshore vessel transfers, reducing downtime.
- **Future Scalability:** Flexible architecture designed to expand for detailed climate models and environmental cost modeling.

**References:** Chatterjee, J., & Dethlefs, N. (2020). XAI4Wind: A Multimodal Knowledge Graph Database for Explainable Decision Support in Operations & Maintenance of Wind Turbines, arXiv preprint.

**Acknowledgments:** ORE Catapult for the LDT turbine data; EU SkillWind project O&M training manual.

