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Modelling the next generation MBSE for Industry 4.0 and IoT to allow scalability and add end-end value

Top Challenge Statement

Real time model update of designed product during development / manufacturing. / Verification ~~artefact~~ & control management system that can check the product conformity to designed virtual model even off through operational life the model will be updated for maintenance or servicing purposes.

Context

High value manufacturing carries a potential risk of mismatch between ~~specifici~~ specification of product manufacturing. Even in the operational life the product may need servicing or update which monitored (by relating) the product to developed product + company

Potential impact

- Preventive maintenance
- Project goes well planned
-

Perceived difficulty

- Amount of sensors or monitoring resources during manufacturing & operation
- Smart modelling system for model update
- Central system to ~~advice on~~ detect potential disalignment ~~between~~ & advising on solution.

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Top Challenge Statement

Establishing sound large-scale models of the interaction between properties of machines and assembly lines and properties of the resulting products.

Context

In order to make adaptation (or design) decisions about assembly lines, we need a predictive capability to predict the effect of different alternatives on product quality. Presently, the only way of establishing these models is through dedicated, small-scale experimentation. It is unclear if this will scale to real production environments.

Potential impact

Having these models will enable quality-led design and adaptation decisions.

Perceived difficulty

High.

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Top Challenge Statement

~~Standard Protocol for communication & interfacing by all stakeholders~~
~~Skills upt~~
Flexibility in automation.

Context

Human has cognitive abilities - automation does not.

Potential impact

Up flexibility for put variation - field process/parts

Perceived difficulty

- sizing
- communication
- stakeholder mapping / cross boundary / skill set working / learning.

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Modelling the next generation MBSE for Industry 4.0 and IoT to allow scalability and add end-end value

Top Challenge Statement

- Building up a standard framework for eliciting requirements, extracting information ~~related~~ under the regulatory ~~cost~~ constraints. /
- Building standard interfaces to link requirements between diverse stakeholders.

Context

Eliciting requirements is a most vital part of product development. In automatic development environment where a central artificial system uses initial input to arrange for process building & resource management, human users will require to follow a ~~stem~~ common framework which needs to be adaptable to user preferences. Provide room for potential changes in specification.

Potential impact

- Disambiguation in communication
- Concise requirements specification documentation
- Clear relationships between requirements
- No down the line hold ups ~~in terms of visits~~ due to potential risks.
- Effective change management

Perceived difficulty

- Ambiguity in natural languages (~~dead~~ multiple interpretations)
- flexibility in frameworks
- Integration of present external constraints (safety standards etc.)
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(5) = 7

Modelling the next generation MBSE for Industry 4.0 and IoT to allow scalability and add end-end value

Top Challenge Statement

Protocols for the communication & Data Representation to make the retrieval easier to make the decision maker Quicker.

end-to-end value? Scalability? (Look Ahead)

Context

Due to the increased volume & complexity of data sets. (Involvement of heterogeneous data sets) from Machines & humans.

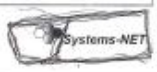
- Standardized protocols across different ~~Made~~ Systems.
- Standardized representation for the different datasets

Potential impact

- Improve the data retrieval & Analytical process to support informed decision Making.
- Avoid information conflict & different system views

Perceived difficulty

- Development of communication protocols & Standard data structure will require understanding of ~~data~~ requirement specs. from whole supply chain level.



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(6) = 11.

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Top Challenge Statement

Data Analysis
Model Fidelity
Over Engineered systems
Real-Time systems

Context

Potential impact

Perceived difficulty

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(7) = ~~5~~

Modelling the next generation MBSE for Industry 4.0 and IoT to allow scalability and add end-end value

Top Challenge Statement

Develop platforms to support manufacturing industry, and relationships to Consumers / Business clients.

Context

To underpin CPS, SoS, and provide security ~~security~~ money transfer, etc

Potential impact

Help UK / EPSRC develop the Digital Economy, and make it convenient to consumers.

Perceived difficulty

Very complex. Will need collaboration beyond engineering; regulation, trust, etc

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Modelling the next generation MBSE for Industry 4.0 and IoT to allow scalability and add end-end value (8)

Top Challenge Statement

Changing educational establishment to produce workforce for the Digital Economy and consumers
CPS and SoS need new classes of skills

Context

Complex CPS, SoS will be in fast evolution and will have many problems due to latent software faults, insufficient V&V, incorporation of legacy systems.

Potential impact

Huge. CPS and SoS need these people to operate efficiently

Perceived difficulty

Complex, requiring change to institutions and cultures. Socio-technical challenge.

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Modelling the next generation MBSE for Industry 4.0 and IoT to allow scalability and add end-end value

Top Challenge Statement

FUTURE SYS ENG ENVIRONMENTS THAT SUPPORT
- EVOLUTIONARY DEVELOPMENT;
- MERGING OF DEVELOPMENTS AND OPERATIONS;
- HANDLING OF COMPLEXITY TO SUPPORT ENGINEERS
- ANALYSIS AND PREDICTABILITY OF SYSTEM PROPERTIES.

Context

- LARGE SCALE CUSTOMISATION
- SYS OF SYSTEMS
- DEVELOPMENT AND EXTENSION OF EXISTING OPERATIONAL SYSTEMS
- INCREASING COMPLEXITY.

Potential impact

Perceived difficulty

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Modelling the next generation MBSE for Industry 4.0 and IoT to allow scalability and add end-end value

Top Challenge Statement

How to integrate different models/views of different parts of the overall system and of different stakeholders into a consistent overall, with an ability to reflect changes in one view on other views

Context Assembly lines are built from machines from different providers, consume materials and products from a range of different sources, and produce (a range of) products. All of these constituents are produced, specified (modeled) and configured independently and using different terminology, but need to be integrated.

Potential impact

Addressing this challenge is fundamental to MBSE and Industry 4.0 as it is fundamental to achieving control of the inherent complexity.

Perceived difficulty

High. The challenge is two-fold:

1. Developing a system for managing viewpoints and their interactions – medium difficulty. This is being worked on in Model-Driven Software Engineering
2. Identifying the most suitable views and their specific interactions

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(11) = 6

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Top Challenge Statement ACHIEVING FIDELITY BETWEEN MODELS OF ANYTHING IN THE REAL WORLD AND THE REAL WORLD.	
Context - ACCURACY OF MEASUREMENT - TIMING ISSUES + DELAYS	
Potential impact - WRONG DECISIONS DUE TO DISCREPANCY OF MODEL VS REALITY	
Perceived difficulty	

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