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Verification of Robotic Systems with Humans in the Loop

DEVELOPMENT CYCLE

A model-driven engineering approach for development and verification of a robotic system with humans in the loop
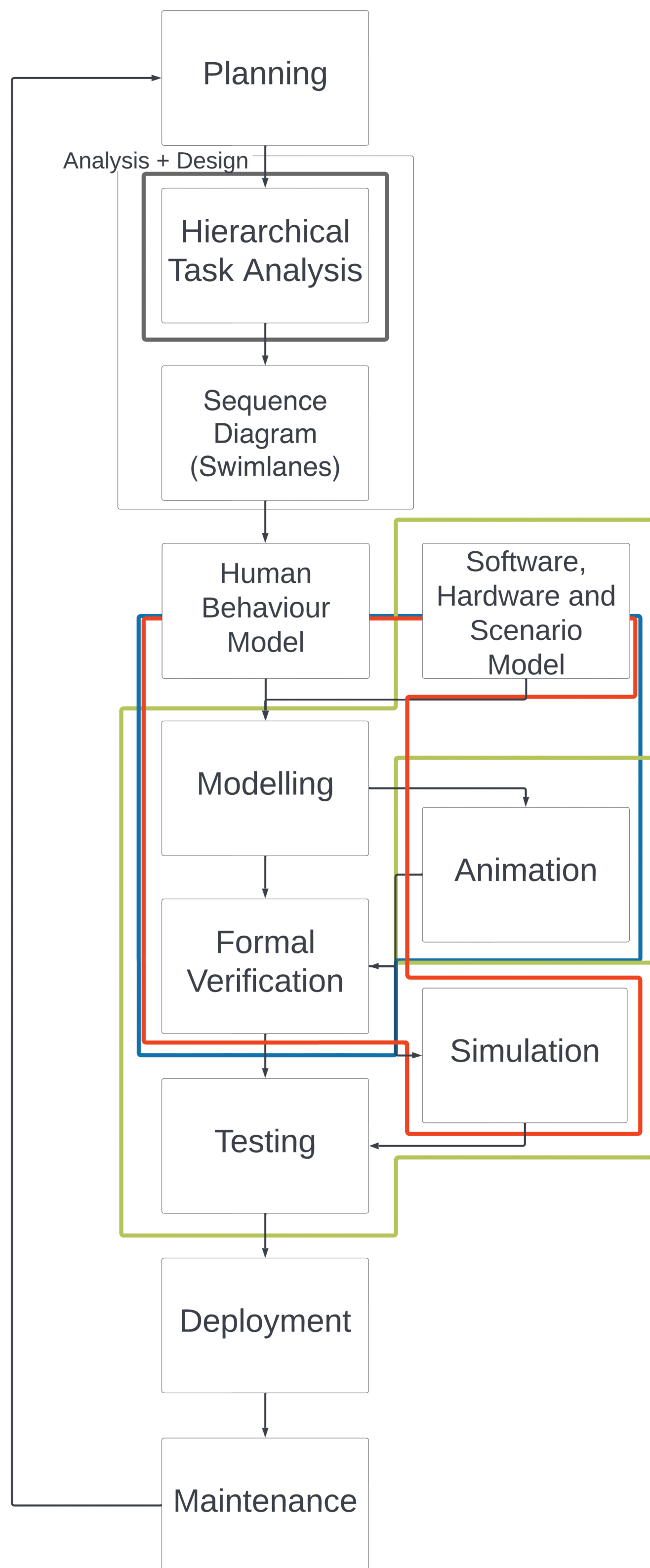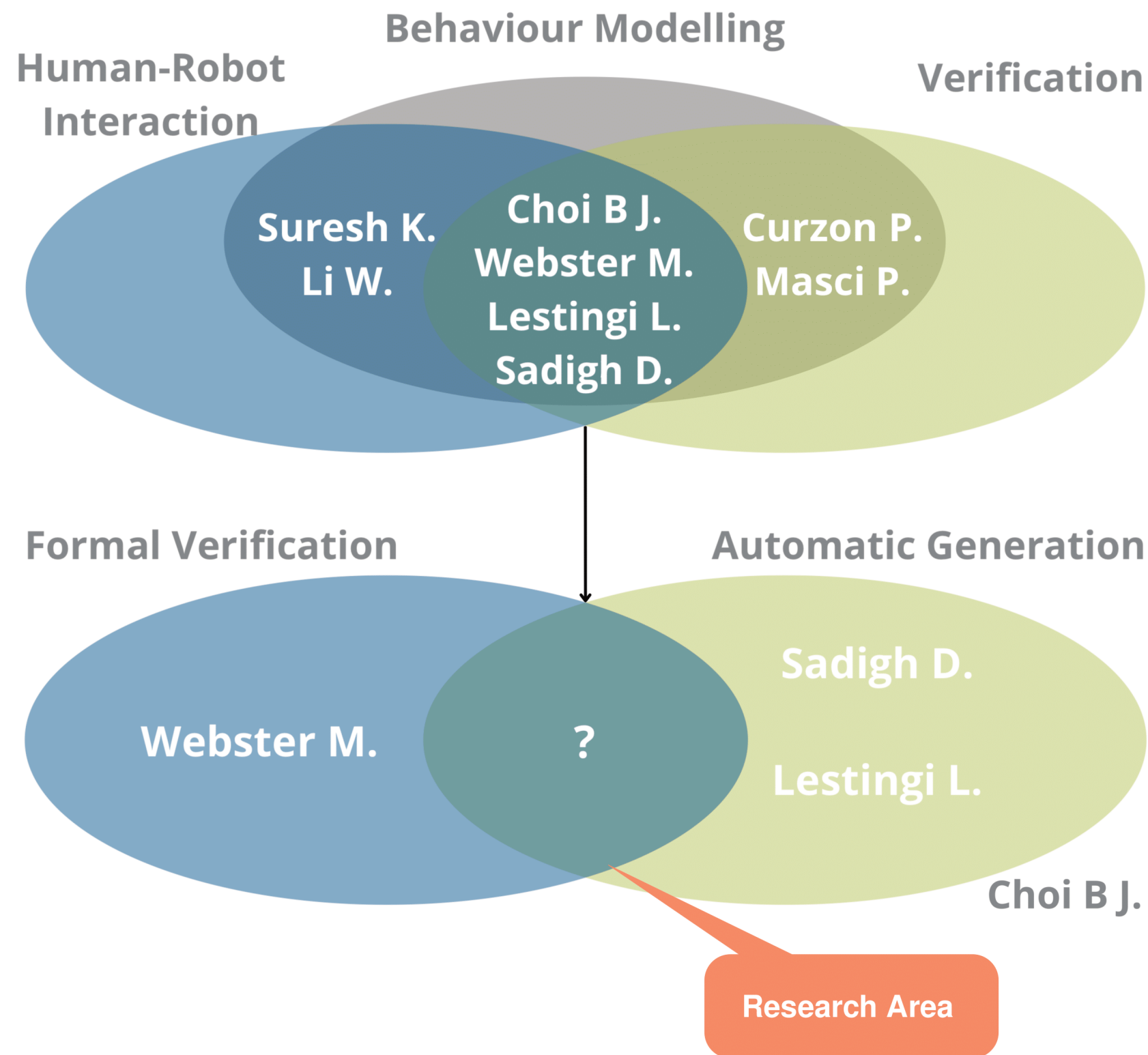

EXISTING TOOLS

CIRCUS
IVY
PVSio-web + PVS
RoboStar

These tools support the correspondingly coloured elements of the development cycle above

EXISTING RESEARCH

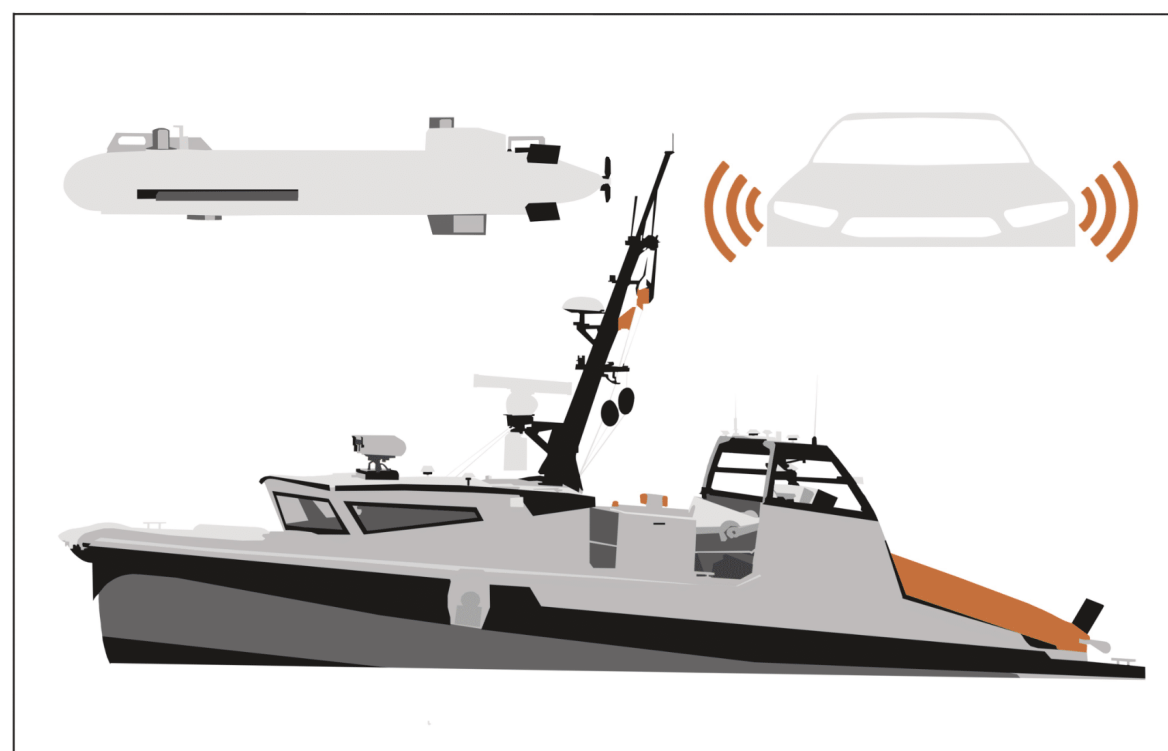Verification through formal methods and with an automatically generated model of the human?

Research Area

PROVING SYSTEM PROPERTIES

A simple example:

After at most 3 minutes, you have 4 acceptable pictures of the target area

To prove this property requires knowledge about these system components:

- Hardware
- Software
- Human

Verification of systems with any autonomous element requires the above: *teleoperated systems, human-autonomy teaming, fully autonomous systems*

References

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.bibtex

BENEFITS OF THE RESEARCH

- A unified, compositional, design and verification approach considering hardware, software and human components of the system
- Automatic generation of artefacts
- Production of rigorous evidence of properties
- Techniques that benefit from rigorous mathematical foundations but do not require mathematical expertise
- Along with the RAEng Fellowship research undertaken by Mark Chattington creates a combined approach from design and verification through to testing

CONCLUSION

The following research goals have been developed:

1. An accessible notation for modelling user behaviour
2. A mathematical semantics for the notation
3. A technique for proving properties which depend on human interaction
4. To demonstrate the technology via case studies

CURRENT WORK

- User needs analysis (Industry interviews)
- UML sequence diagram based notation
- Case study definition