





Survey of Component-Based Software Engineering (CBSE) within IoT Development

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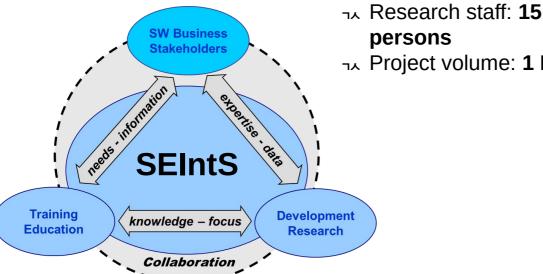
Software Engineering and Intelligent systems (SEIntS) Research Group



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Our paper – CBSE in IoT

- Motivation
 - We are software developers, who like to build IoT prototype devices
 - CBSE method focuses on the design and development of computer-based systems with the use of reusable software components.
 - Has CBSE been used in IoT research?

Goal:

- Focus on software
- Study the use of the software components.
- Discover if CBSE characteristics are present in IoT prototype research.



Example - A typical IoT paper

"Towards the utilization of cost-effective off-the-shelf devices for achieving energy savings in existing buildings"

- Intro and Background
- Architecture Hardware
- Software and architecture
- Test setup

Results

Discussion and conclusion

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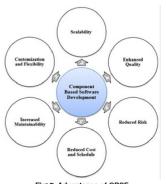
This work has been funded by the Harayson Region.

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CBSE characteristics



Component-based software engineering (CBSE) emerged in the late 1990 (lan Sommervillië, "Software engineering 10.Ed", 2016)

- Composable
 - External access to methods and attributes by using publicly defined interface
- Deployable
 - To able to operate as a stand-alone entity on a component platform.
- Documented
 - Documented so that potential users can decide whether or not the components meet their needs.
 - Component interfaces should be specified.
- Independent
 - Can be used standalone
- Standardized
 - Standard component model, which may define component interfaces, component metadata, documentation, composition, and deployment.



Research method - Literature survey

We used Systematic mapping study (K. Petersen et al, 2015)

- 1) We selected two combinations of search terms:
 - 1) The combination of "IoT", "component based", and "Arduino"
 - 2) The combination of "IoT", "component based", and "Raspberry Pi".
- 2) We excluded studies published before 2020. Most of these are technical studies and were partly discussed before in our earlier studies.
- 3) The studies were reviewed and if there was no mention of the software that was developed, tested or used, the study was excluded from the research.
- 4) The remaining studies were read, and based on the content of each study, it was decided whether or not to include it in the mapping study.



Findings

- Initially 60 studies were included in our survey.
- After previous steps: 26 included, and 34 studies were left out(No CBSE characteristics)
- Composable: 16
- Deployable: 15
- Documented: 11
- Independent: 16
- Standardized: 15
- Overal CBSE usage was low
- Mentioning ready-to-use software components as MySQL-database add the paper in these.
- More detailed examples in research paper







Conclusions

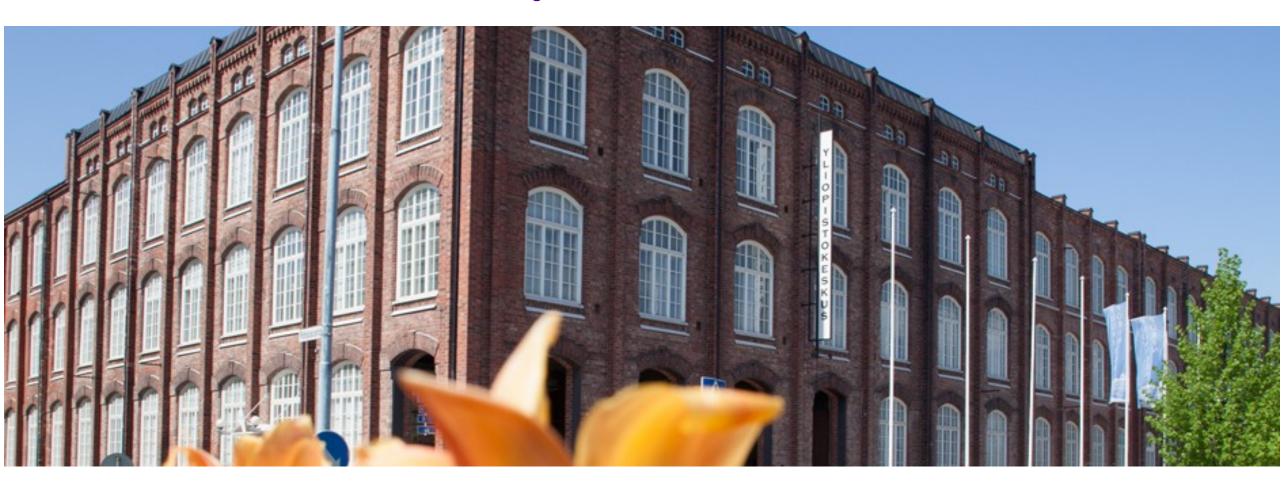
- The aim of this study was to evaluate the current state of the art in the use of component based software development in the IoT world.
- Study also shows the lack of component based software development in IoT related prototype development.
- The survey also shows that the developed and self-made software components are omitted when presenting the structure of IoT applications.
- It can be said that in order for studies to be reproducible, the software side should be described in more detail.

Future research:

- This collection of studies has potential for more comprehensive analysis.
- How to describe software aspects in IoT research publications?



Thank you! Questions?



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