Newsletter IoT4CPS - What´s happening / April 2019

This newsletter provides insights into the current research progress within IoT4CPS. Get updates on milestones and achievements and learn about the faced challenges.

Partner Insights

Infineon

Current achievements

During the last months, there has been an effort to refine the focus areas for each one of our subtasks. Work package 7 therefore mainly focused on the determination of achievements necessary to be actualized in the main industrial demonstrator. Apart from that possible interactions and practicable connections among the project's work packages have been established.

Challenges

Steering such a synergistic work to the directions that fulfill the objectives of IoT4CPS is very challenging since it involves the complete identification of pivotal technology requirements and an ongoing exploration of all technology prospects that are being developed within the technical WPs. On top of that, an overall awareness of the demonstrator architecture and capabilities by the involved partners is in process, aiming to resolve the integration level of each building block and the criteria that meet its purpose.

Outlook

Currently, each partner is working on the hitherto assigned tasks and defined contributions, building upon its own expertise and upon the appropriate collaborations within the project, and is bound for the upcoming milestone, which is the first iteration of the industry 4.0 application demonstrator. This will emphasize on the initial concepts that have been determined so far, regarding to feasible connectivity technologies, traceability of components and systems throughout life cycle, security by isolation, as well as a preliminary integration of the developed building blocks into this demonstrator.

TU Wien

Current achievements

Paper: Adaptive Fault Detection exploiting Redundancy with Uncertainties in Space and Time

Abstract: The Internet of Things (IoT) connects millions of devices of different cyber-physical systems (CPSs) providing the CPSs additional (implicit) redundancy during runtime. However, the increasing level

of dynamicity, heterogeneity, and complexity adds to the system's vulnerability, and challenges its ability to react to faults. Self-healing is an increasingly popular approach for ensuring resilience, that is, a proper monitoring and recovery, in CPSs. This work encodes and searches an adaptive knowledge base in Prolog/ProbLog that models relations among system variables given that certain implicit redundancy exists in the system. We exploit the redundancy represented in our knowledge base to generate adaptive runtime monitors, which compares related signals by considering uncertainties in space and time. This enables the comparison of uncertain, asynchronous, multi-rate and delayed measurements. The monitor is used to trigger the recovery process of a self-healing mechanism. We demonstrate our approach by deploying it in a real-world CPS prototype of a rover whose sensors are susceptible to failure.

At TUW, we just added another sensor, a Time-of-Flight (ToF) camera, to the mobile robot - a prototype of WP6 to apply architecture and methods for safe and secure IoT for CPS. Currently, we are looking into methods to monitor (functionally) redundant but unreliable sensors. A preprint of our work is available on arXiv.

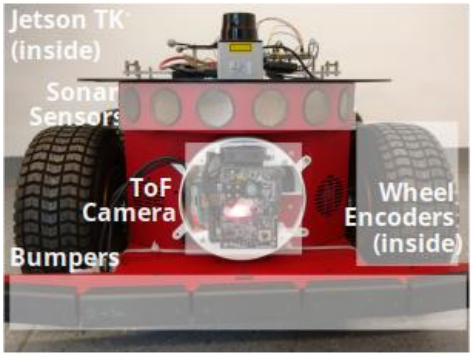
Challenges

The Internet of Things (IoT) connects millions of devices of different cyber-physical systems (CPSs) providing the CPSs additional (implicit) redundancy during runtime. However, the increasing level of dynamicity, heterogeneity, and complexity adds to the system's vulnerability, and challenges its ability to react to faults. A CPS assembled out of many sub-systems provides observations of different CPS variables, which can be interrelated to each other in a knowledge base.

Outlook

TUW works on a monitor querying the knowledge base to find redundancies. The redundancies are then used to detect faults of observation components by comparison. The knowledge base has been encoded in Prolog implemented with the ProbLog library, which enables the user to change the knowledge base during runtime, and add or remove information about the availability of observations. The monitor can therefore master technological or functional changes in the CPS. Moreover, TUW presented an observation model considering uncertainties in space and time (e.g., noise or delays) of observations collected by the monitor. The observation model provides means to compare uncertain, asynchronous, multi-rate and delayed measurements. The developed monitor can be used to trigger the recovery of the self-healing method already presented in deliverable D3.1.

Images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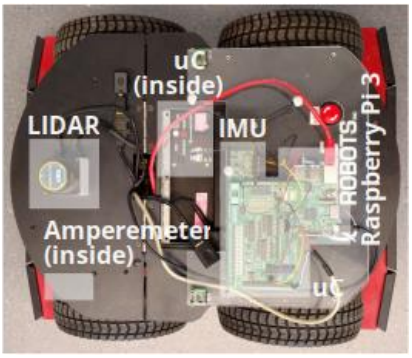
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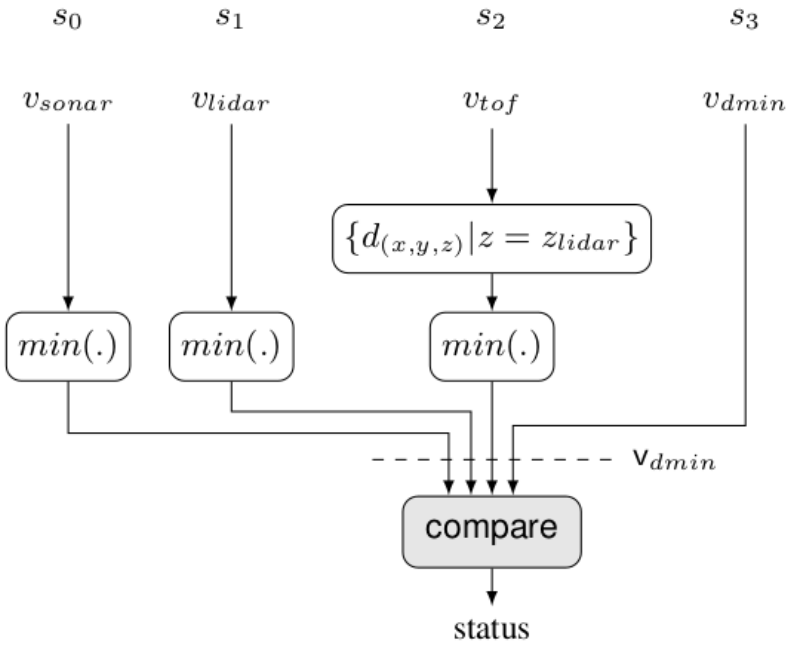
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Austrian Institute of Technology

Current achievements

WP3 released "Design and Methods Concept (D3.1) where we collected potential solutions, tools and methodological building blocks for the development of safe and secure IoT and CPS.

The focus was placed on integration of privacy and on support of the complete engineering, from engineering support to providing potential solutions.

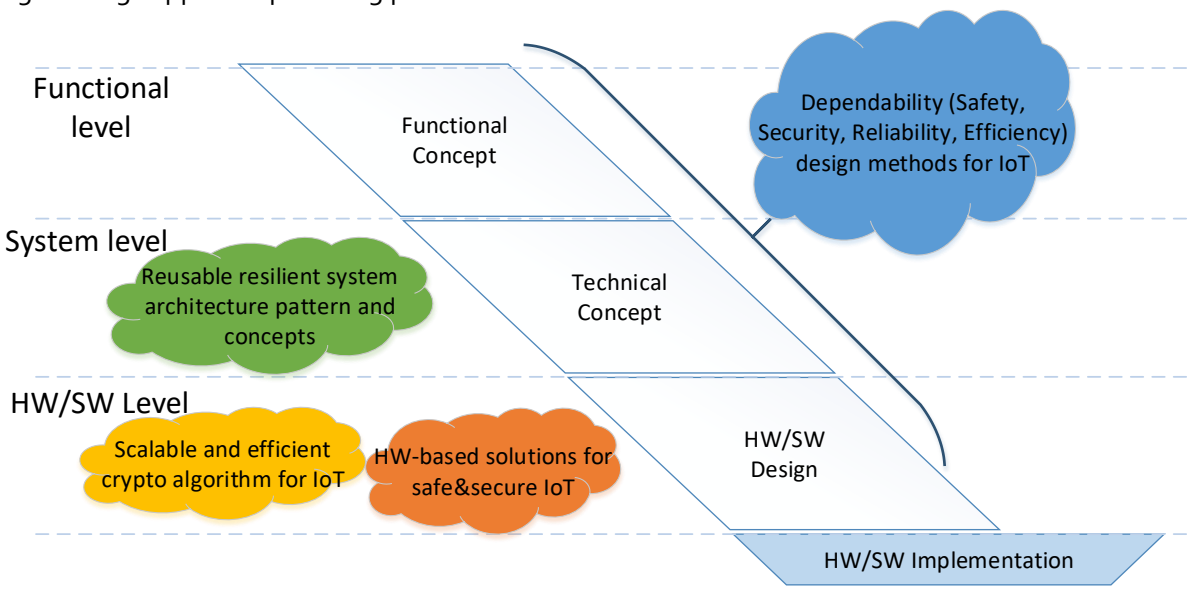

Figure 1: Structuring WP3 contributions along the V-Model

We evaluate how out tools GSFlow and Moreto can be deployed to achieve dependable IoT for CPS. Furthermore, we provide insights on using recommender systems with the goal to increase dependability of IoT. Finally, we report on novel methods for increased reliability of IoT, such as Self-Healing by Structural Adaptation.

We provide an overview about potential approaches regarding safety & security engineering, methods to:

- Identify and assess risks
- Ensure compliance with standards and best practice guidance's
- Optimize risk treatment decisions

Goals and challenges:

Demonstrate our concepts on IoT4CPS demonstrators. Specifically, we want to implement self-healing concept and demonstrate it on our WP6 automated driving use-case. To achieve this, we need to integrate our solution into the Robot Operating System (ROS) based platform of our industrial partners.

Latest Publications

V. Damjanovic-Behrendt, W. Behrendt, "An Open Source Approach to the Design and Implementation of Digital Twins for Smart Manufacturing".
International Journal of Computer Integrated Manufacturing. Special Issue on Cyber Physical Systems with Applications in Production and Logistics. 2018 (impact factor 2017: 1.995). To appear.

A Roadmap Toward the Resilient Internet of Things for Cyber-Physical Systems Denise Ratasich, Faiq Khalid, Florian Geißler, Radu Grosu, Muhammad Shafique, Ezio Bartocci IEEE Access, 2019

Recent Events

IoT4CPS @ Vienna Cyber Security Week 2019

Violeta Damjanovic-Behrendt (Salzburg Research), Omar Veledar (AVL) and Nikolaus Dürk (X-NET) gave an update on the research progress within IoT4CPS at the 2019 Vienna Cyber Security Week hosted at WKO. The session was moderated by Corinna Schmitt and mainly targeted the areas of Digital Twin and Automotive.

In addition to the session "IoT in Industry" Heinz Weiskirchner (Nokia) and Julia Pammer (SBA Research) also represented IoT4CPS in the exhibitor area.



Coming up

IoT4CPS @ IoT Forum 2019

IoT4CPS will be part of the IoT Forum CE 2019 on June 5 at Tech Gate Vienna.

IoT4CPS @ ARES 2019

Coming up!
ARES Conference 2019

University of Kent, Canterbury, UK
August 26-29, 2019

IoT4CPS will be *hosting WISI 2019 – Workshop on Industrial Security and IoT* at this year's ARES & CD-MAKE conference in Canterbury, UK. The conference will take place at the University of Kent (Sibson Building) from August 16-29. 2019.

Call for Workshop Papers