Collaborative Embedded Systems

CrESt

CrESt Newsletter 2 /2018

Welcome to the 2nd edition of the CrESt newsletter. This newsletter reports about latest results and activities in and around the project. All editions of this newsletter will also be available online on the CrESt website under https://crest.in.tum.de/meldungen.html. We are looking forward to your comments and suggestions. Enjoy reading!

Experimental Platform for Platooning: For the CrESt use case UC1 (Platooning) the parts Humboldt University, Assystem, and Fraunhofer FOKUS have built an experimental platform with three 1:10 scale model cars. The students defined requirements for platooning, equipped a RC-chassis with sensors and computing resources, and developed control software using architecture and function models. A special challenge was the communication protocol used by the cars to agree on the planned driving maneuvers.

On May 22nd the results could be presented to the public at the "Tag der Naturwissenschaften Adlershof": At the Humboldt-Kabinett at the department of computer science students from Berlin schools, fellow students, and professors of the institute gathered to life follow the first platoon drive. Radio Berlin-Brandenburg reported from the event in their evening show. Unfortunately only two of the three cars were functioning. However they successfully mastered the basic use case: start jointly – keep distance – jointly stop at an obstacle.
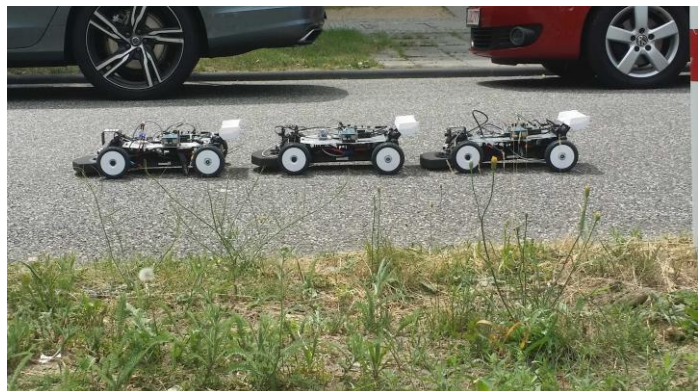
Subsequent to this successful presentation the students will participate at the "Deep Berlin Robocars Competition" (see http://deep-berlin.ai/robocars/). In this competition sponsored by Hella the challenge is to autonomously (not collaboratively) drive through a given race track. Track recognition and control is based on camera information and deep learning algorithms. The race will take place on September 12th, 2018. We keep our fingers crossed for the team.

The results of this semester project can be found under https://www2.informatik.hu-berlin.de/~hs/Lehre/2017-WS_SP-HAF/index.html .

CrEST @ CeBIT 2018: First results of the CrESt project have been presented at this year's CeBIT fair in Hannover. Our showcase included a mobile robot of the CrESt partner InSystems, which handed out flyers to the visitors. The robot moved stochastically over the booth of the BMBF and rand kept an eye on where in the hall it had already distributed flyers to the visitors. This information was further on used as additional information for the route calculation. A monitor showed the learned environment of the robot, including humans, obstacles, and the places where flyers have been taken. In addition

visitors were informed about the CrESt project via a short presentation.

On the opening day our booth has been visited by Federal Minister Anja Karliczek, of the Federal Ministry of Education and Research. Prof. Broy himself introduced her into the showcase and explained the vision and the goals of CrESt.

CrESt Special Session at IEEE CASE 2018 The annual IEEE Conference on Automation Science and Engineering (CASE) is the largest event of the IEEE which is especially devoted to automation. This year, the conference took place in Munich, between August 20 and 23. The program comprised of more than 250 paper presentations in Regular and Special Sessions. One Special Session was dedicated to "Engineering Methods and Tools for the Development of Collaboration-intensive Cyber Physical Systems". This Special Session had been arranged by Wolfgang Böhm (TU Munich) and Alexander Fay (HSU Hamburg) with the intention to bring CrESt researchers and the CASE community together on an international level. Fortunately, seven out of ten papers which had been submitted to this Special Session were accepted by the CASE Program Committee. The Special Session took place on the afternoon of August 22 and attracted up to 40 participants, most of them from outside the CrESt team. As an introduction, the quest for "Reference Architectures for Future Production Systems in the Field of Discrete Manufacturing" was presented. The difficulties of "Hierarchical Simulation of Production

Systems" were explained in the second presentation, which was followed by a catchy talk on "Using Design Space Exploration to Calculate Deployment Configurations of IEC 61499-based Systems". All three presentations raised so much interest that the lively discussions consumed the complete coffee break. The second part was started by "Ontology Building for Cyber-Physical Systems: A Domain Expert-Centric Approach", which introduced how to develop and use ontologies to describe the context of a Collaborative Embedded System. Context uncertainty can be coped with, as described in "Model-Based Documentation of Context Uncertainty for Collaborative Cyber-Physical Systems - an Approach and Application to an Industry Automation Case Example". The next presentation dealt with "Online-Monitoring Autonomous Transport Robots with a R-Valued Temporal Logic". The session was concluded by a presentation of "A Cross-Disciplinary Language for Change Propagation Rules". Again, the audience was keen to learn about CrESt topics, and stimulating ideas came up during discussion, before all participants left for a typical Bavarian dinner in a "Bierkeller". Curious to get to know about the authors and content of the papers? Have a look at https://ras.papercept.net/conferences/conferences/CASE18/program/CASE18_ContentListWeb_3.html and search for "WECT7" and "WEDT7" to learn more!
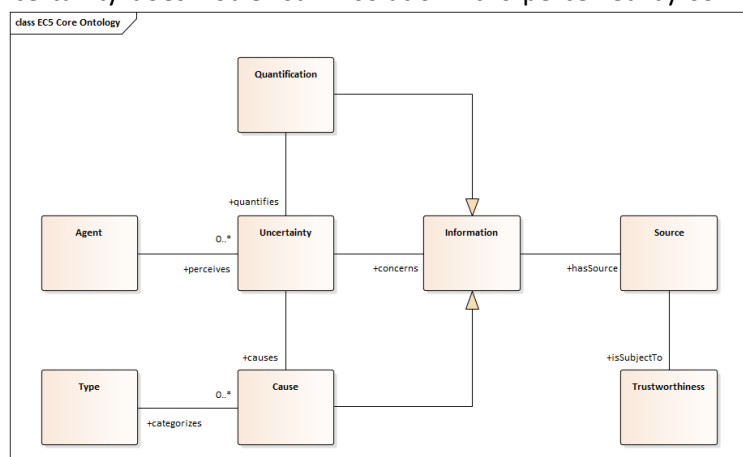
CrESt Simulation Workshop: The CrESt Simulation Workshop was held successfully on February 20th at Assystem Germany in Berlin. 20 participants from 12 CrESt partners joint the event to gain a better common understanding regarding simulation activities within CrESt, to learn about existing tools for simulation, and to find mutual connecting points between various ECs, SQs and MQs.

It was agreed to establish regular CrESt Simulation workshops twice a year to further align simulation activities by involved partners. The next workshop will take place in September or October 2018, probably in southern Germany.

EC researchers develop domain-crossing ontology for context uncertainties. Researchers from EC5, besides participating in the ongoing standardization work at the Object Management Group (see last newsletter), are progressing on developing a CrESt-specific ontology for modeling uncertainty in the operational context of collaborative embedded systems. The ontology depicted represents a generic core that is supposed to be applicable for all use cases considered in CrESt. It also serves as a means to align different contributions in both modeling and analyzing uncertainties throughout EC5.

The basic idea is to have the *Uncertainty* concept to serve as a container for multiple concepts that characterize a specific uncertainty. Uncertainty does not exist in isolation. It is perceived by some *Agent* and concerns a specific piece of *Information*. For example, in the platooning use case, a vehicle processes information about the environment, such as obstacles, pedestrians etc. This information always has a source which may be subject to *Trustworthiness*, e.g. when another vehicle in a platoon provides information. The *Quantification* serves to put a number on the uncertainty, e.g., in the form of a probability distribution. Further-

more, the uncertainty has a specific *Cause* which in turn is categorized in terms of uncertainty *Types*. This will help in selecting appropriate mitigation strategies later on. For instance, a potential cause may be inherent sensor imprecision, which can be categorized as a perception-related type of uncertainty. Notably, the concepts *Quantification* and *Cause* are derived from *Information*, which means that they can be subject to uncertainty themselves. This allows considering uncertainty on different layers. Future work will be dedicated to elaborating mitigation strategies for specific uncertainty types and enabling the nesting of uncertainties to facilitate modeling of uncertainties that are the result of multiple uncertainties.

Resources. Further information on the CrESt project is available on the project website under https://crest.in.tum.de/.

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