InSecTT Newsletter October 2022

Welcome!

This is the **October 2022 edition** of the InSecTT newsletter, highlighting news & achievements from InSecTT during Q3 2022.

Please distribute this newsletter to all interested parties in your organization. We appreciate your feedback, please send comments or requests to Insectt@v2c2.at.

Enjoy the reading!

Content

Successful Y2 Review at Brussels!

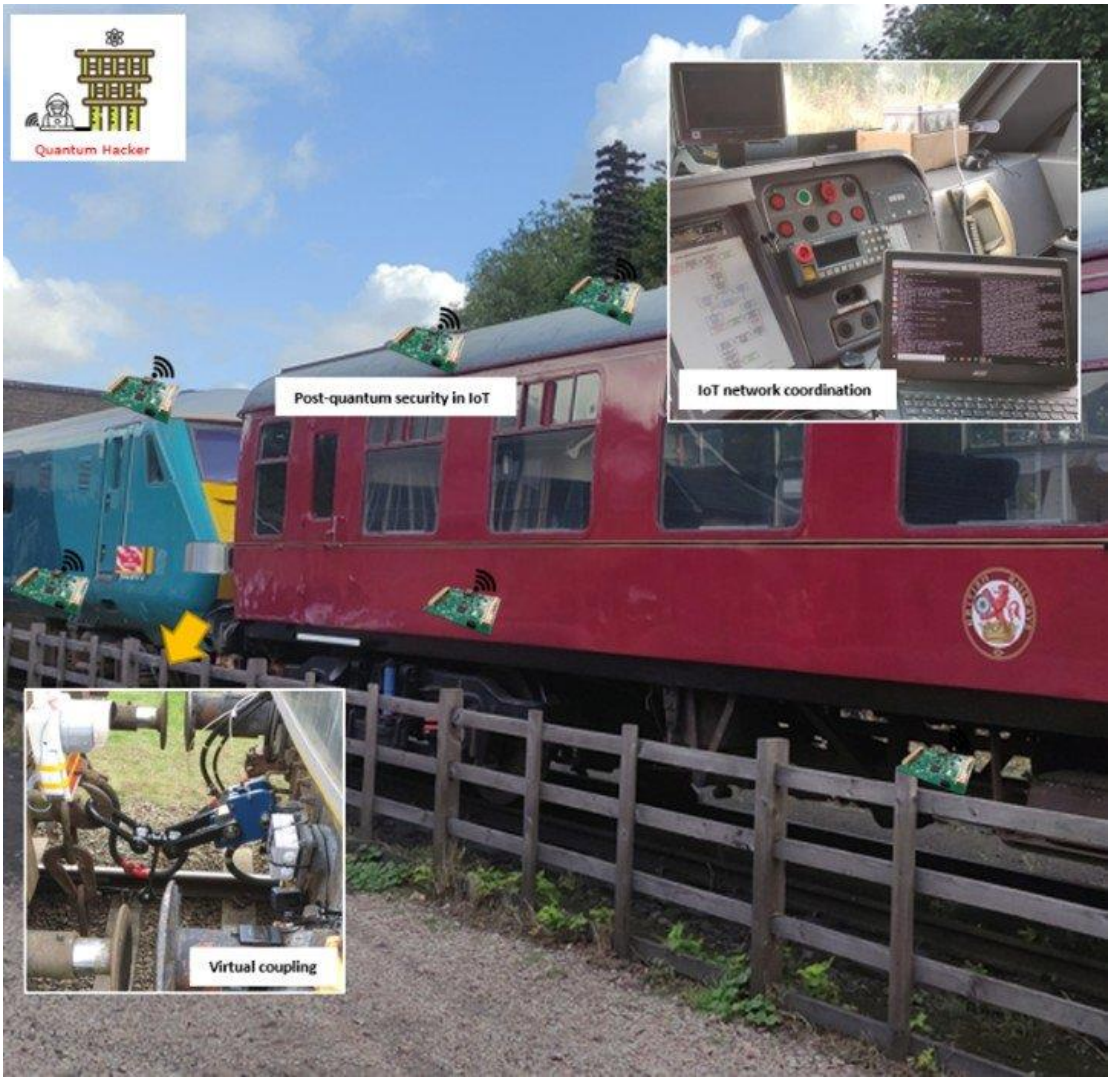
Sep 30, 2022

The InSecTT project has started mid-2020. After a virtual-only review last year, the InSecTT consortium is happy (look at the faces!) to meet again in person in Brussels, Belgium at the JU to do the review of the 2nd year results. After two days fully packed with presentations and demonstrations we can report a successful Y2 Review. A big thanks for the good feedback and advise received by the project officer @Francisco Ignacio and the reviewers @Birgitte Lønvig and @Stamatis Karnouskos

Post-quantum cryptographic schemes for IoT edge devices

Sep 26, 2022

In InSecTT project, researchers of UPM investigate post-quantum cryptographic schemes for IoT edge devices, along with AI Deep learning based processing for LiDAR point-clouds, Ultra-Wide Band (UWB) technology for precise distance measurements and wireless sensor networks based on custom modular hardware platform for run-time train integrity. All these works are integrated in a railway domain, targeting autonomous train performing.



Podcast #8: Do you trust AI? How to make things "trustworthy" with Peter Mörtl

Sep 22, 2022

Do you trust AI? How to make things "trustworthy"?

Anamarija interviews Peter Mörtl from VIF about what "trust" really is, how to make things trustworthy and what the research project InSecTT contributes through its "Trustworthyness Framework".

As InSecTT is also about developing AI methods and technologies for future applications, the question needs to be asked: can we trust AI?

Tune in using the Podcasting app of your choice, or go to https://podcasts.apple.com/at/podcast/project-insectt/id1605747720

Podcast #7 available: Michael Karner on coordinating InSecTT

Aug 29, 2022

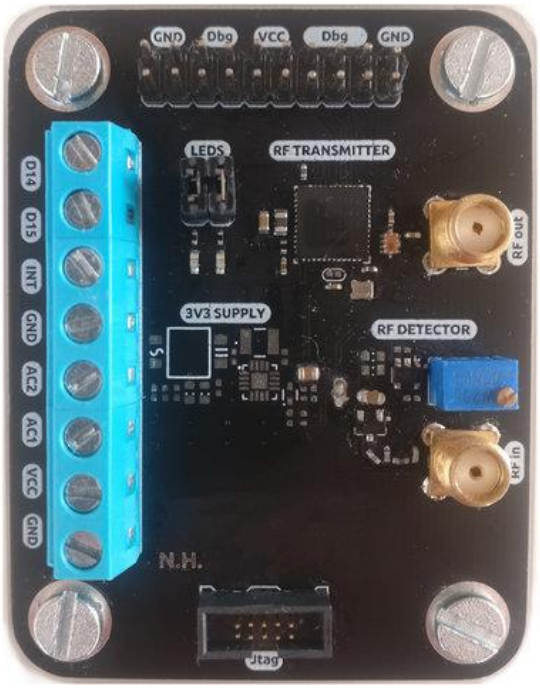
Guest in episode #7 of the InSecTT podcast is Michael Karner, the coordinator of project InSecTT. Michael talks about the challenges of coordinating such a large project as InSecTT, especially during the Covid-19 pandemic. What is the "secret sauce" from managing a successful project?

Get this and all previous podcasts on https://podcasts.apple.com/at/podcast/project-insectt/id1605747720 or your favorite podcast catcher.

Batteryless RF Information Harvesting

Aug 11, 2022

As part of InSecTT, TU Delft developed radio-frequency (RF) information harvesting, a channel sensing technique that takes advantage of the energy in the wireless medium to detect channel activity at essentially no energy cost. RF information harvesting is essential for event-driven wireless sensing applications using battery-less devices that harvest tiny amounts of energy from impromptu events, such as operating a switch, and then transmit the event notification to a one-hop gateway. As multiple such devices may concurrently detect events, coordinating access to the channel is key. RF information harvesting allows devices to break the symmetry between concurrently transmitting devices based on the harvested energy from the ongoing transmissions. To demonstrate the benefits of RF information harvesting, TU Delft integrated it in a tailor-made ultra-low power hardware MAC protocol called Radio Frequency-Distance Packet Queuing (RF-DiPaQ) and built a hardware/software prototype of RF-DiPaQ to study its performance at scale. Comparing RF-DiPaQ against staple contention-based MAC protocols, It can be seen that it outperforms pure Aloha and 1-CSMA by factors of 3.55 and 1.21 respectively in throughput, while it saturates at more than double the offered load compared to 1-CSMA. As traffic increases, the energy saving of RF-DiPaQ against CSMA protocols increases, consuming 36% less energy than np-CSMA at typical offered loads.

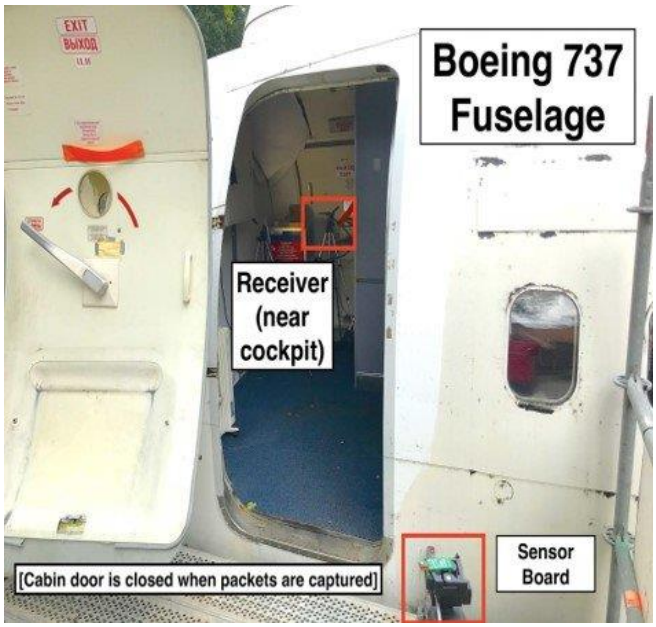


Wind energy harvesting wireless sensor

Aug 10, 2022

TU Delft has developed a wireless batteryless avionics sensor, called Hermes, that simultaneously enables piezoelectric energy harvesting as well as sensing, making it self-powered and batteryless. Using a set of piezoelectric films which flutter due to incoming wind the sensor can accurately determine the wind speed(U) and Angle of Attack(α) of the incoming airflow. After conducting wind tunnel testing to characterize the generated voltage signal of these piezoelectric films, an AI algorithm for sensing and modelling the sensor dynamics has been designed and evaluated. The estimation error of U is below 0.2 m/s and error of α is within 1.2◦. The sensed data is communicated wirelessly in an WAIC.

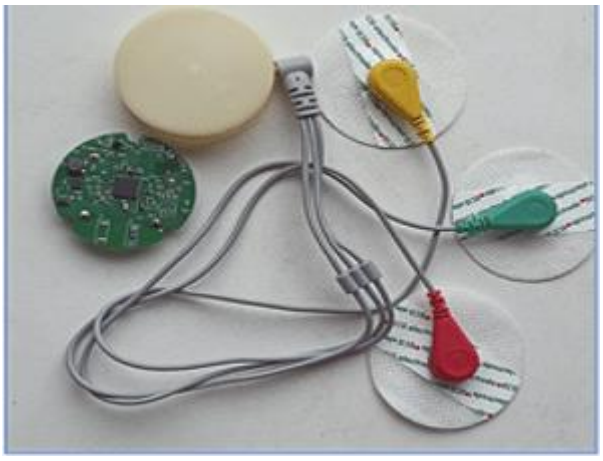
Experiments were conducted inside an actual fuselage of Boeing 737 to measure its performance under realistic wireless signal attenuation and propagation conditions. The wireless sensor represents a class of new energy harvesting wireless sensors which will be fitted in aircraft of the future to improve reliability of the different systems and ensure safer flights. The sensor has been patented and the work involving the design and working of the sensor has been published in Robotics and Automation Letters 2021 as well as presented at the International Conference on Intelligent Robots and Systems (IROS) 2021.

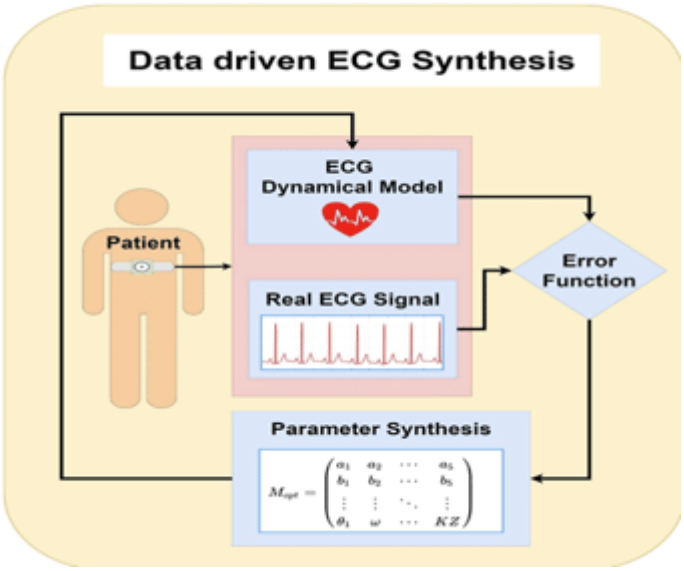


Wearable IoT device: Heartwatch for smart, continuous ECG monitoring

Aug 9, 2022

TU Delft has developed a wearable IoT device, Heart Watch, that enables smart monitoring of body temperature and ECG of a person 24x7. The system generates synthetic ECG signals from clinical data in real-time using a dynamical systems model in conjunction with a training-free, real-time machine learning algorithm for learning the ECG generation parameters. The parameters of the trained system are then transmitted in each cycle of the ECG wave to reconstruct the original signal using the same model at the medical practitioners' location. The advantage of such a system is that only a set of parameters are transmitted to a central server instead of raw ECG data. In addition, systems can be trained to detect and classify disease conditions as one of the parameters, which can be transmitted along with signal parameters. TU Delft’s systems currently achieve an average processing time for clinical data of one second in 0.68 seconds on a microcontroller, with an RMSE error of 0.0038, for 17 parameters per ECG cycle. This system is also easy to implement, requires minimal storage (only one ECG cycle at any given time) and does not depend on offline training.



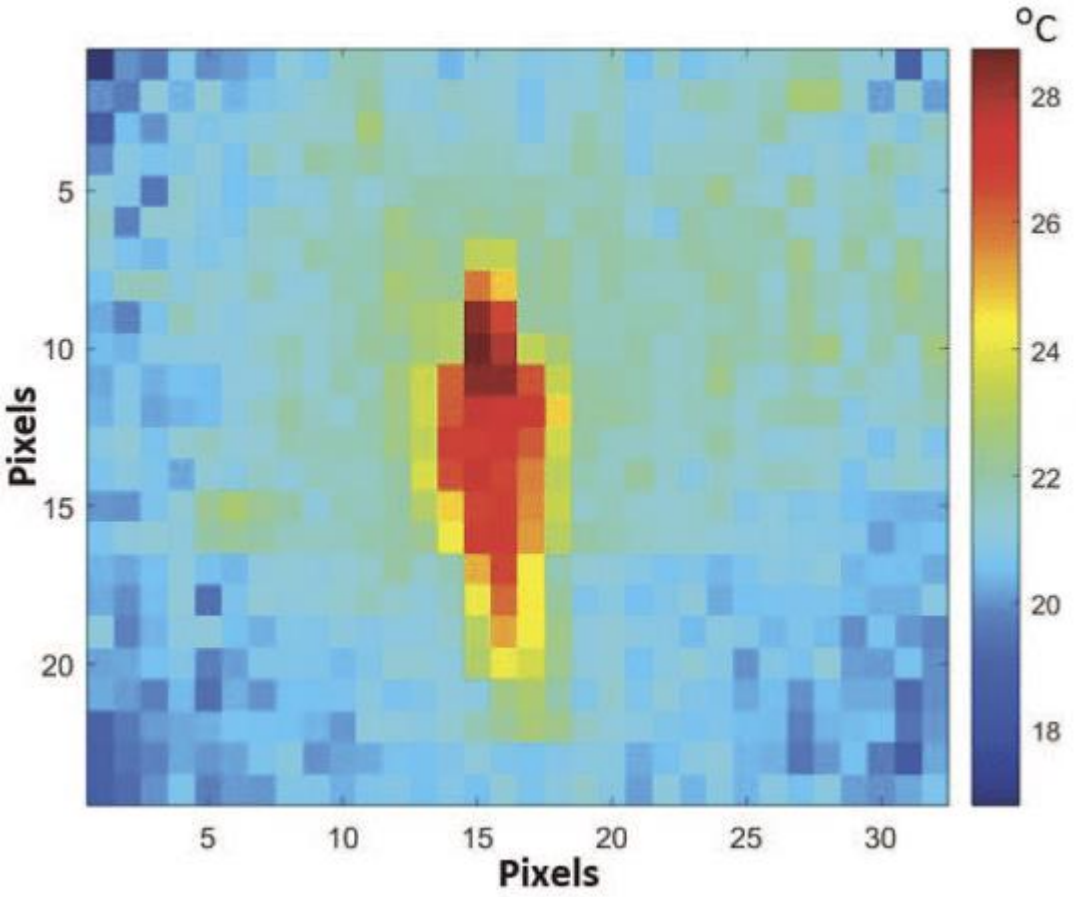


Small, low-power, privacy-aware localization

Aug 8, 2022

TU Delft as part of the InSecTT project has developed a privacy-aware system called LOCI that can perform joint localization, occupancy detection, and tracking. LOCI comprise of a fusion of two sensors Passive Infra-Red (PIR) sensor employed as a depth sensor and a thermopile sensor (Melexis 32×24 array). Such a combination of sensors also enables it to localize multiple people. While this system is extensible to other applications such as user

movement tracking, fall detection, it does not extract personal information that high resolution cameras do. Hence, the system is GDPR compliant. One LOCI sensor unit is sufficient to cover the area of 8m x 8m. AI algorithms estimate the position and occupancy, and machine learning techniques are employed to make this solution work seamlessly in most indoor locations.



InSecTT

InSecTT at 59th Design Automation Conference (DAC 2022)

Jul 6, 2022

InSecTT Project Coordinator Michael Karner (Virtual Vehicle) will present the InSecTT project and give a talk about "Bringing Internet of Things and Artificial Intelligence together – But is it Trustworthy?" at the 59th Design Automation Conference (DAC 2022). Join us on 11-July 11:00-12:30 in session "Embedded Systems and Software".

InSecTT Podcast #6 is online: Johannes Peltola from VTT on AI research in InSecTT

Jul 1, 2022

In this episode, Anamarija talks with Johannes Peltola from VTT about developing AI building blocks in InSecTT. Is data the new oil? What applications are there being researched in InSecTT? And how hard is it to lead the work package #2 in such a large project?

https://podcasts.apple.com/at/podcast/markus-pistauer-from-cisc-on-trustworthy-iot/id1605747720?i=1000559698763

InSecTT at IoT Week 2022

Jun 20, 2022

InSecTT Project Coordinator Michael Karner (Virtual Vehicle) will present the InSecTT project and give a talk about "Bringing Internet of Things and Artificial Intelligence together – But is it Trustworthy?" at IoT Week 2022 taking place in Dublin, Ireland. Join us at 23-June 11:00 in session "Identity, trust and privacy in an intelligent, smart IoT World. Challenges and outcomes - Session 2: AI and ML technologies as enablers for a more secure IoT", organised by projects ERATOSTHENES and ARCADIAN-IoT.

Interference tracking and prediction in wireless sensor networks

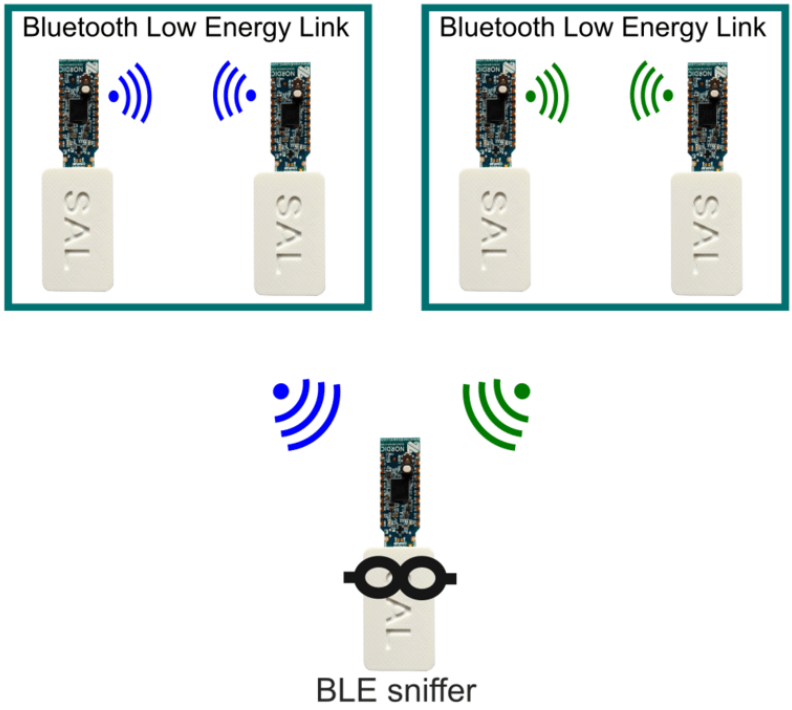
Jun16, 2022

In the scope of Silicon Austria Labs work on interference tracking and prediction in wireless sensor networks, their researchers have implemented methods to track active Bluetooth Low Energy (BLE) connections over time and predict future collisions with the own network. By listening to only one BLE channel the algorithm is able to reconstruct the connection parameters of all active BLE connections with low-cost HW, which is definitely beyond state of the art. The targeted applications are:

- Improve coexistence with other communication standards by avoiding access to the channel at predicted collisions.
- Follow active BLE connections and sniff the exchanged data (while it is not needed to be present at the initialization of the BLE connection).
- Instead of jamming the whole 2.4 GHz ISM band, apply synchronized jamming with the possibility to only disturb certain links or nodes.

If you are interested on this topic, example measurements of sniffed BLE connections are published as open-source dataset in:

Julian Karoliny, Thomas Blazek, Hans-Peter Bernhard, & Andreas Springer. (2022). InSecTT BLE Channel Sniff Dataset. https://doi.org/10.5281/zenodo.6523365

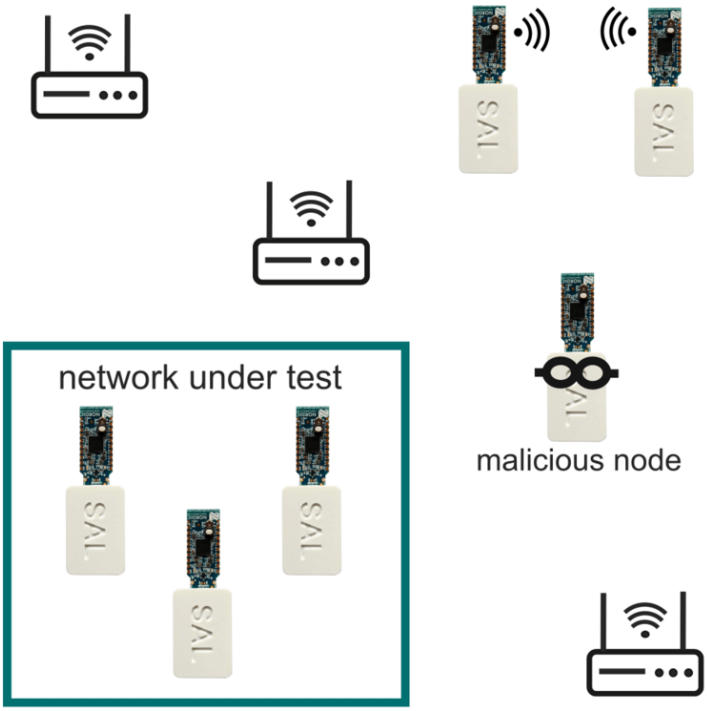


Distributed Channel Monitoring

Jun 15, 2022

Silicon Austria Labs is working on a distributed channel monitoring solution that is capable to measure interference directly as a real part of an industrial sensor network. The work is being developed as part of the Use-Case 3: Wireless Security Testing Environment for smart IoT in the #InSecTT project. This low cost solution (requires minimum and low cost hardware) enables to evaluate interference caused by other networks/devices, find unusual (intended) interference behaviour due to malicious devices, track inference, perform predictions on future channel access and apply counter measures for own network.

#H2020 #InSecTT #wirelesssystems #SAL



Optimal Wireless Network Structures

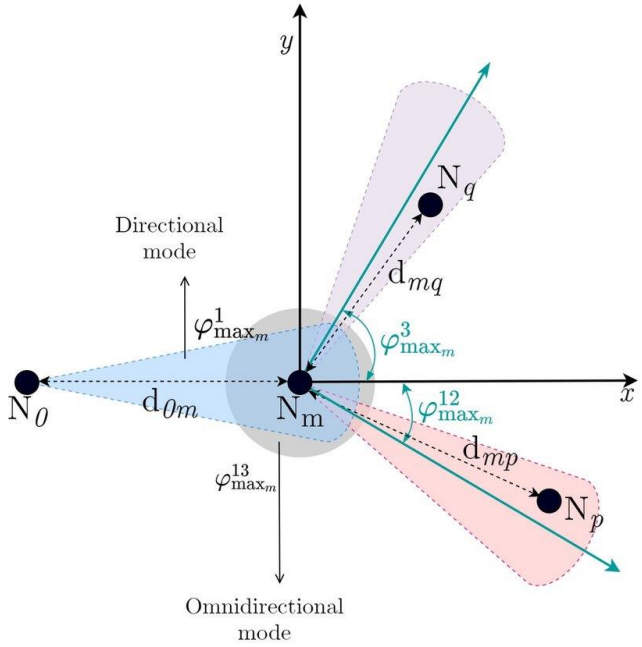
Jun 14, 2022

As part of the Building Block BB3.4 in the InSecTT project, Silicon Austria Labs is working together with Gdansk University of Technology in developing an algorithm that finds the best network structure by minimizing latency and maximizing SNR. This solution is based on QoS criteria and considers a switched beam ESPAR antenna developed by researchers at GUT. The algorithm provides a hierarchical structure of the network sorted in layers of relay nodes, where each relay node is capable to operate either in omnidirectional or directional mode.

The results indicate that by utilizing a directional mode with just as low as two switching beams can reduce the number of layers by 65% and still maintain the same QoS criteria. This solution can be especially beneficial in delay-critical applications.

See more about this topic on our recent publication “Relay-Aided Wireless Sensor Network Discovery Algorithm for Dense Industrial IoT Utilizing ESPAR Antennas” published in IEEE Internet of Things Journal.

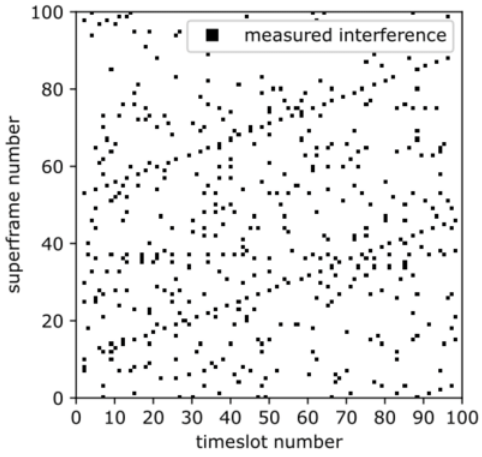
#InSecTT #SAL #GUT

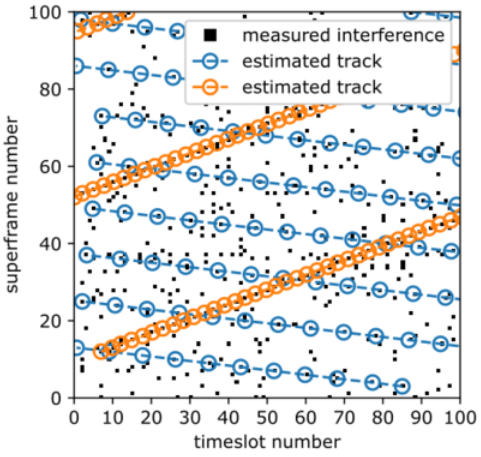


Multi Hypothesis Interference Tracking algorithm

Jun 13, 2022

Silicon Austria Labs (SAL) is working on Multi Hypothesis Interference Tracking algorithm that is capable to detect and track periodic interference in a wireless channel. The main goal is to find different sources of interference and distinguish them by their channel access behavior. If the channel access is not random, which is for example the case for many low-power and synchronized WSNs, it will show a certain pattern, e.g., periodic channel access. This allows to detect and synchronize to these patterns which are then used to identify the source of interference, estimate the transmission frequency, predict future channel access, avoid collisions with own network.





How can Artificial Intelligence help in Driver Distraction Detection?

Jun 3, 2022

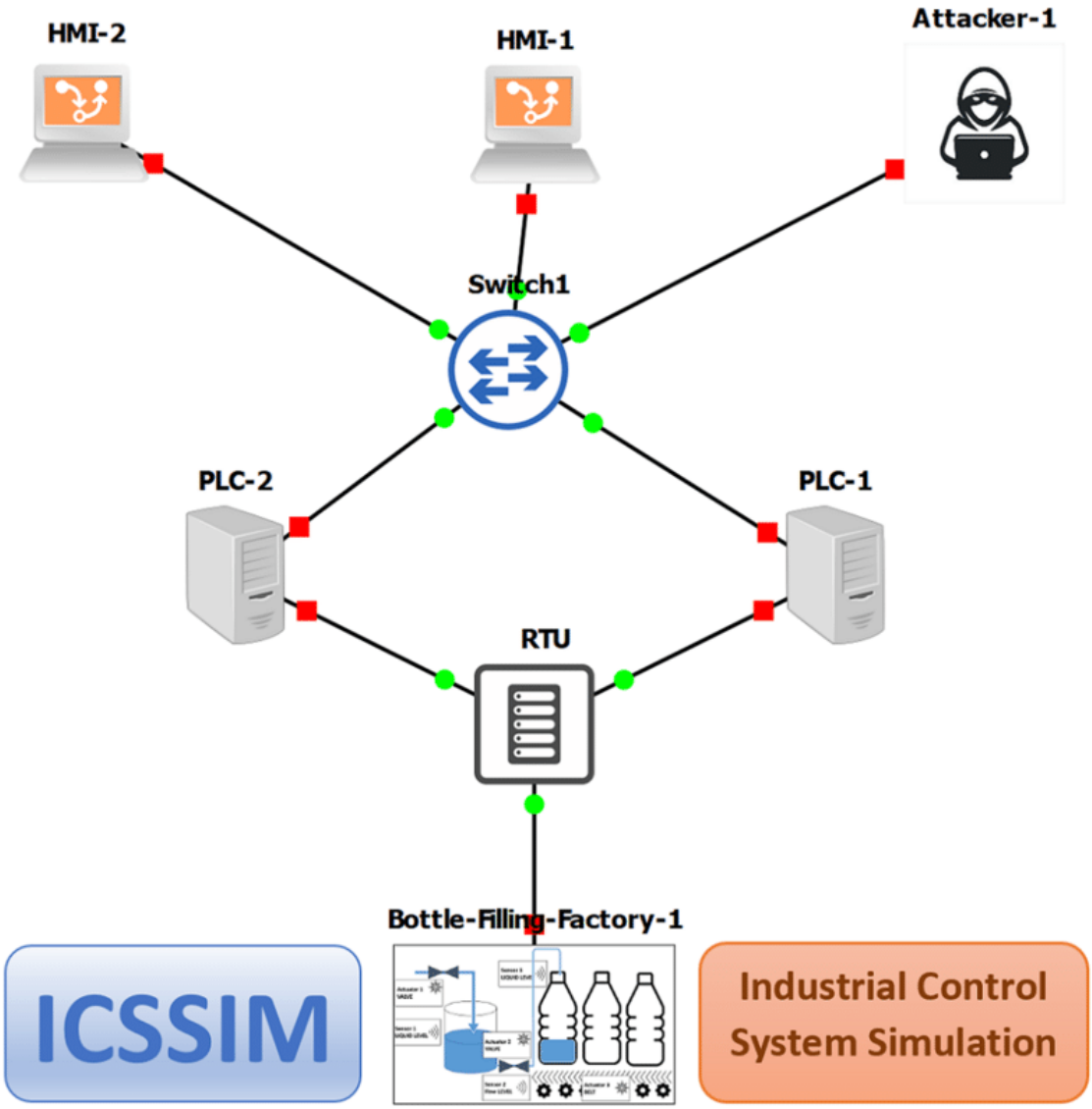
RISE Research Institutes of Sweden is leading a use case on "Driver Monitoring and Distraction Detection using Artificial Intelligence" in the InSecTT project. Researchers from RISE are working together with EU partners from industry, research and academia to provide a solution to improve driver distraction detection processes in order to reduce risks and accidents. Technical challenges include: (a) labelling driving distraction data efficiently without compromising privacy, (b) predicting distractions in real-time depending on edge computing.

ICSSIM – A Framework for Building Industrial Control Systems Security Simulation Testbeds

Jun 1, 2022

ICSSIM framework (Developed by “#RISE” in #InSecTT Project) is to simulate customized virtual Industrial Control Systems (ICS) security testbeds, which facilitates attack/threat investigation. Through ICSSIM, realistic details and high-fidelity ICS testbeds are produced that are extendable, versatile, reproducible, low-cost, and comprehensive. (Link: https://github.com/AlirezaDehlaghi/ICSSIM)

The Docker container technology is used in ICSSIM, which enables realistic network simulation and isolates the ICS components on private kernels for a private operating system. As well as reducing the time spent developing ICS components, ICSSIM also enables physical process modeling using software and hardware.


HMI-2
HMI-1
Attacker-1
Switch1
PLC-2
PLC-1
RTU
Bottle-Filling-Factory-1
ICSSIM
Industrial Control System Simulation

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