OVERVIEW LIT PROJECTS, CALL 1/2016
Fully autonomous driving (Level 5) is only possible if the self-driving vehicle is able to recognize and evaluate all - even highly complex - driving situations and environmental conditions, and make appropriate decisions based on these situations. This is a highly ambitious goal and can only be attained by applying advanced, artificial intelligence methods.

Prof. Sepp Hochreiter’s project LSTM4Drive develops new neural network-based methods that can evaluate a continual feed of camera images and other sensor data. These methods will help to recognize and anticipate situations, even those that are not visible on single images but can only be reliably recognized over time (such as another vehicle wanting to make a turn).
Financial crises, negative interest rates, and falling stocks can result from misunderstanding financial dynamics. Prof. Milan Stehlik’s team has developed practical multi-criteria decision rules to address survival questions about our shaky economy. His team can predict financial developments, explain how negative money appears, and provide practical guidelines for financial and insurance operations.
CHARON – CONTROLLING A RELIABLE QUANTUM COMPUTER
LIT SEED PROJECT: COMPLETE CONTROL SOFTWARE FOR RELIABLE QUANTUM COMPUTERS

Reliable quantum computing architectures are created based on the decision to use unreliable hardware in conjunction with high performance quantum error correcting codes. A quantum computer will not be able to execute any computation in the absence of a control software. Dr. Alexandru Paler’s team is working on CHARON to create an open sourced proof of concept for a complete control software in reliable quantum computers. CHARON aims to prepare a software framework to be included within the next decade into the first large scale quantum computer.

Visualisation of a quantum error corrected circuit. CHARON will control the execution of the circuit.
Research groups led by Prof. Andreas Springer and Prof. René Mayrhofer are researching new security measures against cyber attacks within industrial environments. Future wireless communications between machines will be based on the same standards as used for mobile phones. The new security measures should ensure that only authorized machines can communicate in a secure manner.

https://redshift.autodesk.de/industrielles-internet-internet-der-dinge/
SENSORS FOR JOINT DISEASES (ARTHROPATHY)
LIT SEED PROJECT: SENSING ARTHRITIS WITH INNOVATED, INTEGRATED TOOLS (SAINTS)

The LIT project “SAINTS” by Dr. Voglhuber-Brunnmaier and Dr. Reichel (Institute of Microelectronics and Microsensors together with the Kepler Universitätsklinikum) is developing and exploring new innovative kinds of microsensors designed to detect joint diseases such as arthrosis, arthritis, and gout. These sensors analyze the complex flow behavior of joint fluid (rheology) and gout-induced crystallization.
To protect itself from exertion and heat, cells produce the heat shock protein Hsp70-1A. Some tumors, however, have this protein permanently, and it is often located on the tumor’s surface. These tumors usually develop resistances to radiation and chemotherapy and spread aggressively throughout the body. Dr. Constanze Lamprecht (Institute for Biophysics) is attempting to decipher the still unexplained role of Hsp70-1A in cancer cells.
Simulating complex, dynamic systems is associated with a large amount of computing. Using statistical methods, so-called “recurrence plots” in particular (figure on the left), Dr. Thomas Lichtenegger aims to identify recurring patterns in multi-phase flows. The information on their behavior will accelerate current simulations by several degrees of magnitude, with the hope of eventually possessing real-time capabilities.
Dr. Moritz Brehm and his team have made a breakthrough in integrated semiconductor physics: they have developed the world’s first silicon quantum dot laser to be used for faster data transmission while also reducing power consumption on computer chips. For this purpose, the quantum dots are incorporated into micro-resonators.
A single atom is enough in order to be chemically identified. **Dr. Stefan Müllegger** and his team have created a unique measuring instrument, paving the way for ever smaller quantum machines and circuits, as well as improved catalyst molecules and nano-medical active substances.
We already see it in nature: Highly developed animals are made of soft materials. Using this as a model for a new generation of soft, adaptive, and smart systems, Prof. Martin Kaltenbrunner and his team at the Soft Electronics Laboratory are exploring diverse applications ranging from robotics, medical technology and healthcare, to entertainment electronics and using renewable energies.
Subduing our impulses and exercising self-control is important in order for people to reach goals. Various technological developments promise to increase this capability.

**Assoc. Prof. Nicole Kronberger** and her team are exploring the chances and risks of these developments in our everyday lives.
“Wearables” are wearable technologies that help to collect electronic information about various types of human behavior, interactions, and experience patterns. The potential usefulness for this kind of information in psychological research is enormous, but there is little research available on its reliability and explanatory power.

Prof. Bernad Batinic and his team are managing the WIP project, examining psychometric quality criteria and the added value of “wearable data” in psychological research.
HARDWARE FOR FUTURE QUANTUM TECHNOLOGIES
LIT CO-FUNDING PROJECT: SCALABLE AND FULLY TUNABLE QUANTUM DOTS FOR QUANTUM TECHNOLOGIES

- Semiconductor quantum dots (QD) - or “artificial atoms” - are being hailed as promising building blocks for quantum communication and information. However, unlike natural atoms, it is very difficult to produce QDs. **Prof. Armando Rastelli** and his team are working in the JKU’s cleanroom to create innovative technology designed to individually control each QD so that their characteristics can meet precisely predefined specifications.