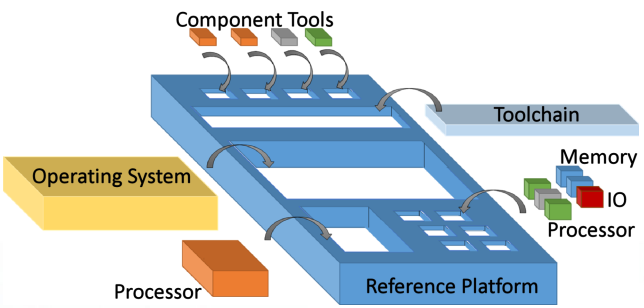
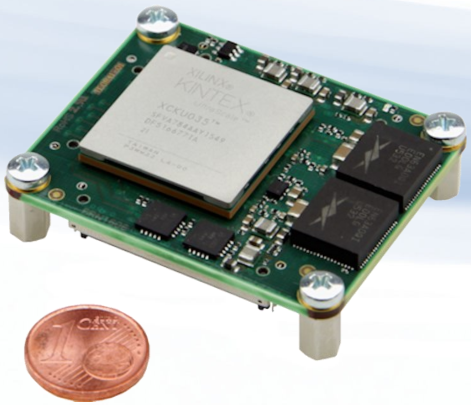
Tulipp: Reference Platform



Define implementation rules and interfaces between heterogeneous HW, OS and Toolchain



COTS Tulipp Hardware Concept

Improvements compared to 2013	End of Tulipp 2018	5 years later 2023
Peak perf. per watt	x 4	x 100
Average perf. per watt	x 10	x 200

Consortium members:

Ruhr-University Bochum (Germany)

Norwegian University of Science and Technology (Norway)

Fraunhofer (Germany)

Synective Labs (Sweden)

Efficient Innovation (France)

Hipperos (Belgium)

Sundance Multiprocessor Technology Ltd. (United Kingdom)

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Towards Ubiquitous Low-power Image Processing Platforms

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Use Case

Surveillance and Rescue UAVs

Goal: Bring intelligence to the drones

Small Unmanned Aerial Vehicles (UAVs) have entered a large range of applications as their underlying technology has improved and more avenues for use have been explored. Now applications such as Surveillance, Search and Rescue, Video production, Logistics and Research are now just a small subset of their uses. Their use in the entertainment domain is rapidly growing as the results vs cost ratio becomes more competitive.

However with the growing number of UAVs in use the number of crashes and problems with their control are also increasing. These problems can be caused by operator error or malfunction. In the worst case scenario these errors can cause damage to more than just the UAV involved and end up harming people, goods or infrastructure.

If the UAV had a more intelligent control system, such as automatic collision avoidance or more robust poise estimation, then these problems would reduce. The problem is that more intelligence needs more computing power which is normally very limited on a UAV.

The TULIPP solution aims to fill this processing gap by using its good performance to weight and power consumption to weight figures.

In this UAV use case we plan to use computer vision algorithms such as depth estimation and obstacle detection to evaluate the surroundings and make the UAV more intelligent.

Use Case

Medical X-Ray Imaging

Goal: Reduce Radiation Dose by 75%

Modern day surgery requires that the surgeon has precise control of their movements and at times is able to see the path that blood flows though veins and arteries. This is not the sort of thing that can be seen without the use of complex imaging systems. Depending on the type of surgery being undertaken, it could be X-Ray imaging that is used. Current X-Ray sensors are more like digital cameras than the plate and films of old, and as such can provide live images and video in real time. One problem with such technology is that when the radiation levels are set low so as not to put the patient at risk, the digital sensors are very sensitive to noise. Increasing the radiation level dose does reduce the level of noise, but can have serious adverse effects on both the patient and the surgeon.

Keeping the radiation level at safe levels and at the same time producing a clear live real time image, often at tens of pictures per second, requires significant processing power.

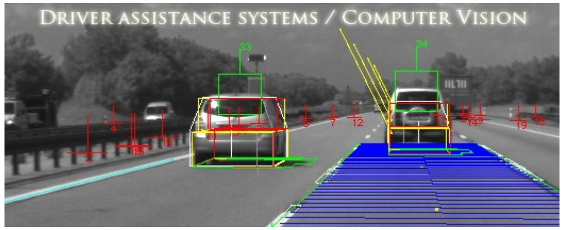
In the Tulipp project our aim is to try and reduce the level of radiation by 75%. As a result of this, more powerful image processing will be required in order to still be able to see many of the small details in the human body that are crucial during surgery. Since most operating rooms are small, the device needs to be small and mobile. A system that integrates the processing close to the sensor would be ideal to help reduce extraneous wires.

The system needs to be compact but also have a low power draw since heat and other RF emissions could disturb the sensors and eventually actually add more noise to the signal.

The system must comply with hard real-time constraints as part of regulatory constraints regarding devices used in medical environments. This combination of requirements makes this use case a challenge to design and develop a matching solution.

Use Case

Advanced Driver Assistance



Goal: Safer driving experience

Advanced Driver Assistance Systems, ADAS, are currently one of the most promising segments for image processing with a steep expected growth rate for the next five to ten years. Driving safety, in parallel with pedestrian safety, has a large focus in the automotive sector, with vision based systems as one of the enablers for many new and innovative solutions. Also automotive safety organizations, like Euro NCAP, are updating their standards and will in a step-wise fashion over the next years require more and more active safety systems in the cars. Some of the most interesting application areas include, Vehicle, pedestrian and object detection, Traffic sign recognition, Lane detection, Night Vision, Surround view and Driver monitoring.

The data gathered from the systems are used, very often in combination with data from other systems, to either guide or assist the driver, or to take control of the vehicle by automatic braking, automatic lane keeping, park assist etc. These applications will over the years be refined and enhanced, resulting in fully autonomous driving solutions some ten years from now.

ADAS vision systems require real time, low latency processing, at high to very high computational load. They need to be robust and reliable, and will often be treated as safety critical systems. The Tulipp project addresses all these questions - by offering a toolset and standardization, it will help the designers to focus on the image processing application rather than platform details. The Tulipp ADAS use case shows how a typical automotive vision application, pedestrian detection, can be facilitated by the Tulipp platform and how characteristics like low power, high performance and robustness are natively supported.