

Intellectual Property protection for sensors in the IIoT

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The IoT brings increasing intelligence to sensors. While the computing footprint for this is limited, the use of such integrated intelligence must be protected by licensing. With Sentinel Fit, Gemalto has developed the smallest licensing solution, which can be integrated into virtually any microcontroller.

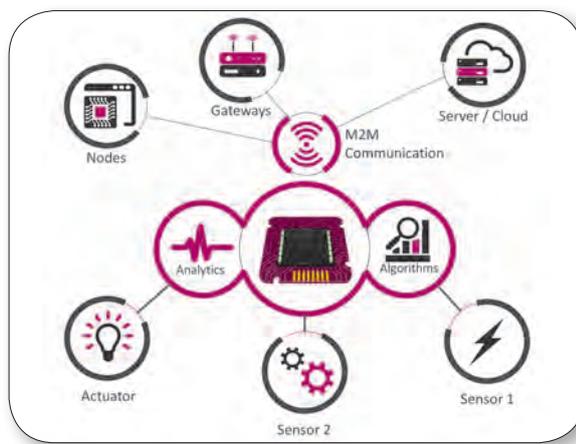


Figure 1. Microcontroller-based IIoT nodes with one or more sensors/actuators contain valuable code that deserves IP protection and should also be monetized through licensing solutions.

■ Most of the billions of IoT devices are smart sensors and actuators. They send data on fertilizer and moisture levels to vineyard owners, sometimes for each vine; they tell the driver where to find the nearest free parking spot; they turn off street lights when the moon is bright or there isn't anybody around; or they are integrated into all kinds of devices, machines and installations to provide status information to operator clouds. This invariably requires a certain device intelligence, not just for analyzing and processing the captured data but also for transferring it via different – sometimes encrypted – communication standards.

Let's take brightness sensors as an example. They measure brightness via photocells and convert the data into digital signals. If this data is analyzed directly in the smart sensor and parameters it can be defined, a basic level of intelligence is already implemented. If the sensor is able to send this data to IoT gateways via wireless interfaces, it is even smarter because this requires packaging the data for transmission and handling the entire communication. If the smart sensor is also capable of receiving data from other sensors – for instance, to add up measurements from three different sensors before transmitting them – it is even more intelligent. And if it then also features an integrated actuator that turns the lights on or off, the intelligence of the

decentralized sensor-actuator node contains enough lines of code to call for Intellectual Property (IP) protection. The same applies, of course, to analog communication modules that link less intelligent sensors and actuators in a modular manner.

Such protection is absolutely essential, because the more IP a smart sensor contains, the more interest from hackers and cyber criminals in gaining access to the device IP. They may steal the code to make their own pirated copies or for sabotage attacks. If an elevator gets stuck or the heating stays cold, as happened in November 2016 in Finland, this may be comparatively trivial. Yet even such manipulation of smart building electronics needs to be prevented effectively. The protection of IP through licensing is not just a security measure. It also opens up all kinds of opportunities from flexible license management. For example, vendors can develop platform strategies using standardized hardware and provide individual product variants based solely on software configurations. This allows them to achieve greater economies of scale that offer scope for defining new price and profit targets. Other options available to vendors include timed, pay-per-use and function-based licensing models. A flexible licensing policy for IoT sensors and actuators can enable entirely new business

models. Take, for example, the brightness sensor that is used in the home to control the sun blinds depending on the time of day and the angle of the sun light. The logic required is quite different from that of a street light sensor designed to dim the lights when the moon shines in order to save electricity. Both are smart sensors but require a different algorithm to achieve the application-specific functionality. For sensor manufacturers, this can lead to completely new sales scenarios, since the sensor manufacturer offer is no longer differentiated just by the physical capabilities of the sensor, but also by the integrated logic that the manufacturer of the street light or blind logic now buys as part of the package. All the latter has to worry about is installing an app in the cloud, on the tablet or the smartphone with which to manage the smart devices. Smart sensors will therefore also change the way in which suppliers work together in the electronics segment. Since the software is the key player in this, it needs protecting as well as licensing. Interestingly, the same licensing tools that are used by software vendors in the commercial sector can also be used here. At least, if they were designed to be completely independent of the used operating system and processor or microcontroller. Gemalto has developed such a solution with Sentinel Fit, which is also the smallest licensing system

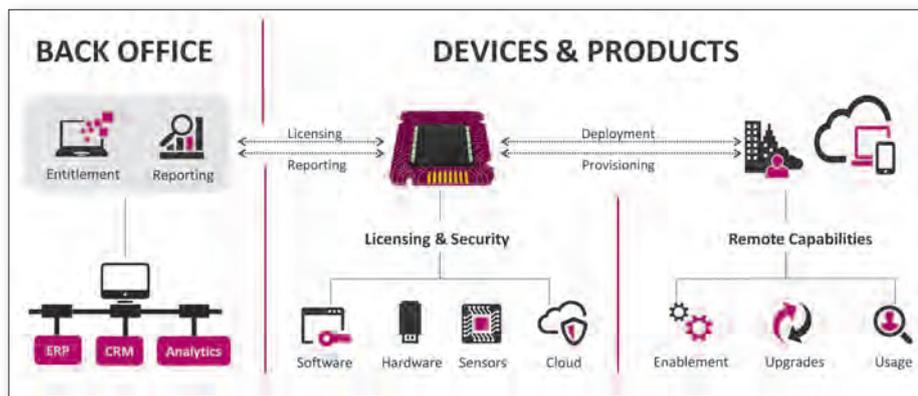


Figure 2. The more devices in the field are connected to the IoT, the more important it becomes – for deployment and provisioning as well as licensing and reporting – to connect all these devices as efficiently as possible.

in the world. It is platform-independent and can therefore be used in any microcontroller and operating system configuration capable of providing 1.5KB RAM and 6.5KB flash for the licensing footprint. It is suitable for many different devices – from smart headsets and wearables to home automation devices, smart city applications, smart meters and countless other industrial sensors, actuators and communication modules. The system can be used, for example, with typical microcontrollers such as the ARM Cortex M3/M4, Intel Quark or AVR/Arduino and Raspberry

Pi or 8051, 68k, PIC/MIPS or MSP430 with an embedded operating system or as bare metal installation without OS. For all these processors, Sentinel Fit offers the option to implement asymmetric RSA encryption as an off-the-shelf solution, which also allows remote updates to enable or disable feature access. As far as the technical specifications are concerned, the microcontroller needs to provide just 13KB RAM and 34KB flash for the licensing footprint. For even smaller footprints optional symmetrical AES encryption is available requiring only 1.5KB RAM and

6.5KB flash. Because licensing is not limited to specific microcontrollers or OS, it can be used in any configuration. This makes it also suitable for tablet or desktop processors, but in those cases, use of an even higher level of security is recommended. Having said that, operating a smart sensor completely without license protection is not advisable under any circumstances.

Sentinel Fit is available in C source code and integrates flexibly into existing embedded toolchains. Due to its modular design, unnecessary functions are easily removed to achieve an even smaller footprint. As the more powerful Sentinel RMS license management system is already available for development environments such as Labview or Matlab and Simulink, the flexible, open source Sentinel Fit can also be used here. It also offers a comprehensive modular kit for license and entitlement management that ranges from licensing tools to – optionally cloud-based – licensing management systems for OEMs, and also provides interfaces to leading ERP and payment systems for process automation. To this extent, professional licensing systems differ significantly from tools for generating a license key. If developers decide to use these professional tools, they automatically get the basis for the flexible marketing of their solutions. ■