Mr. Jan Dvorak's
Experiences List

Some examples of devices and technologies I developed in the past, of course together with my team.

1. Control system for liquid handling robots

1.1 Production grade manipulators

This was maybe the biggest task I ever did. Years lasting cooperation with a small England based company producing liquid handling (pipetting) automats for health care. We helped them to innovate their production portfolio, the most of their production is now based on the electronics we've developed.

1.2 Gadgets for chip incubators

Chip incubators in a LifeScience lab. A lot of pumps, valves, sensors, heaters and gasses around. Governed by an electronics originated on my desk. Some of them ended up in a (semi-)mass production.

2. IT security - LabIT

2.1 Insulation/Firewalling inside a Local Network:

Examples:

- Computers in an office. A virus or a hack cannot propagate from the infected one to its neighbor because network connection between them simply do not exist even when they are on the same local network.

- For instance a CNC milling machine or a chromatograph - it could access the database server it needs, browse its manufacturer web page and for instance the operator can connect the device from his office computer, but that's all. All other connections are impossible even over the local network. And it is freely configurable anytime.

- A DNA sequencing machine in a lab or a production supervising device on a production belt - it is allowed to send protocols and results by email by no email (or other unwanted connection) could reach it.

The beauty of the method is no expensive network hardware is needed. The technology can be applied to any pre-existing network or to a single computer.

2.2 Custom backup a data transfer systems

Various softwares, servers and technologies for customized data backup and data transfer. An extreme security, the shortest possible after-fail recovery, computer and data diagnostics embedded in the backup process, thorough antivirus detection, etc. Various tailored custom-made systems we did.

2.3 Antivirus CheckBox

Inserting an infected or suspicious media (like an USB flash stick) to a computer implies a risk - will the antiviral software catch the virus (if there is one) or will it infect my computer? Should I try the stick (or CD, DVD, external harddisk) or trash it forever?
Our CheckBox is a small computer equipped with one or several antivirus scanners. Of course it can be infected during the scan. But when the checked media is removed the CheckBox automatically and quickly refreshes and reboots itself back to the original fresh and clean state.
(The device contains a technology licensed by the Masaryk University of Brno which I developed there years ago.)

2.4 Virus-spread preventing devices

- USB media eraser simply erases and cleans the inserted medium. Good for wiping infected media and for data privacy. Better and cheaper than trashing the medium...

- “Copy” - a file-server based technology for distributing files between computers safer way than a removable medium or a cloud is.

- USB flash stick with RW/RO switch.

- USB flash stitch with “erase knob”.

2.5 Secure internet gateway

This is an usual local network to internet gateway with two extra features.
Firstly it provides a web antivirus proxy - web pages are scanned for viruses before they enter the user's browser (HAVP for http and local personal instance of virtual computer for https protocol for data safety is not compromised for the user).
And the second is an optimized stateful firewall. No packet can reach the internal network (or a part of it) unless it belongs to a connection originated by the internal computer.

2.6 Safe Computer

Various computers based on a special hardware or on a heavily used virtualization for fulfilling very strict security needs.
Computers for testing viruses, for dealing with suspicious emails, for browsing dirty web pages, for safely accessing critical technologies, honeypots, etc.

3. Closed chambers telemetry

3.1 Acoustic overwall communication

Various systems for monitoring temperature, humidity, pH, light color and intensity, O2 and CO2 concentration and many others. The main problem is the monitored chambers are closed or even hermetic ones and there is no possibility to run wires over the wall. And the walls are made of metal so there is no realistic way to use a radio communication. We sent the data acoustically over the wall.

3.2 VLF communication

We used very low frequency radio for communication over bulky non-metallic materials. Monitoring of an argon filled concrete bunker is a good example. And telemetry transmitted from the bottom of a deep pond was a funny task.

3.3 Energy harvesting

Many of these closed chambers communicators needed to harvest energy from the environment to power itself. Utilizing light, movement, temperature difference, temperature changes, gas flow, etc.

4. Electronic devices, especially cutting-edge ones

- Front-ends for extra small pH and ion-selective electrodes
- Statistical measurement of electric signals produced by living cells, things like electric ‘noise’ produced by moving sperms, working alveoles, phagocyting leukocytes, etc.
- An innovative (and highly DSP based) method for driving gel electrophoresis leading to much sharper bands, to better separation.
- RF spectrum conductivity monitors for watching liquid purity and thermal stability in tissue engineering. (Ended up in some pharma companies, possibly supervising production purity there.)
- Various custom thermometers and thermostats, up to 0.001K relative resolution and 0.01K absolute stability.
- Precise samplers for sampling vapors just above level.
- 3D impedance imaging system for tissue engineering.
- Low noise driver for electro-acoustic modulator for laser metrology.
- Precision front-end hardware for radiation spectrometers. (Ended up in mass production.)
- Extremely low-noise high-voltage power sources.
- Test equipment for medical ultrasound transducers.

- Computer based image post-processing system for medical ultrasound (used in early cancer detection).

- Freezers, manipulators and incubators for in-vitro-fertilization process research

...and many others...