Internet of Sensors

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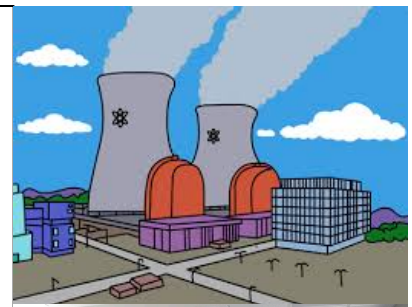
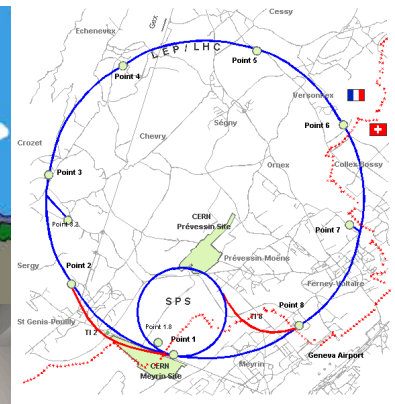
Introduction

A huge amount of radiation monitoring is performed, on a daily basis, in and around research centers, nuclear installations, university laboratories, hospitals, industrial facilities and military sites. Part of it relies heavily on measurements performed by trained operators. This introduces additional variability and error prone data recording, does not allow for continuous sensitivity, raises issues of monitoring difficult-to-access locations. Merging data from different sources can be a daunting task. For this reason, there is the **clear need of reliable radiation monitoring systems**, which offer **high sensitivity**, are **continuously active**, **easily deployable**, **easy to operate**, and produce standardized, easy to analyze data.

In order to be of practical interest, the devices need to be robust, and resistant to adverse weather, temperature variations, vibrations and mechanical shock. The system must operate largely unattended and with minimal maintenance. The system is likely to be battery powered, therefore ultra low power consumption is a requirement.

Moreover, the system must integrate appropriate data transmission facilities (e.g. GSM, WiFi, RF), and acceptable cost is critical for scalable systems.





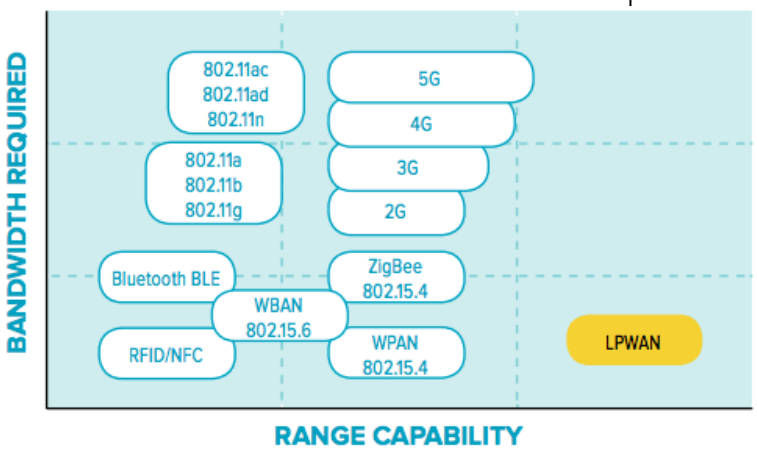
IoT: 6 billion connected things by the end of 2016, 20 billions by 2020. 5 million new things get connected every day.

The Internet of Sensors (IoS) concept

The recent availability of affordable solid-state radiation sensors, of reliable and cheap micro-controllers and memories, together with new developments in the fields of wireless communication (i.e. LPWAN), low power microelectronics and efficient batteries, make possible building a practical, fully automated and remotely controlled network of radiation sensors. The development of a network of smart radiation sensors is perfectly aligned with powerful trends in the contemporary technological landscape, as the far-reaching concept of the "Internet of Things" (IoT).

The goal of the Internet of radiation Sensors (IoS) project is to design, build, test and operate a network of smart radiation sensors.

The initial development of the IoS project is thought for the CERN environment: considering the availability of unique infrastructure, distributed over a large geographical area, the variety of skills and expertise, and the highly diversified testing ground for radiation applications, CERN is in a truly unique position to host this research.



Low Power Wide Area Networks (LPWAN) as LoRa and Sigfox provide a practical way to transfer a limited amount of data over long distances with minimal power consumption. It is a fast developing technology quite interesting for our application.

Potential Impact

The IoS project has potential applications in **environmental monitoring**, **individual dosimetry on the workplace and for the general public**, **monitoring and tracking of radioactive materials**.

Environmental monitoring of large areas, with a distributed network of sensors providing measurements in real time with high granularity

Personal dosimetry: including data integration between personal dosimeters and monitors for environmental measurements (including radon)

Automatic tracking of radioactive sources in laboratories: provide continuous real time information of the location of the source (useful also for protection of first respondents)

Transport of radioactive materials: continuous data recording allows to reconstruct with great accuracy the status of the source, and offers a very effective, documentable way to establish that the source has not been tampered with.

The IoS project can branch out into many applications for hospitals, environmental protection, monitoring of nuclear infrastructures etc. It may as well provide a platform for monitoring elements of environmental risk beyond radiation.

Promises to be a **disruptive technology**, replacing a number of existing hardware solutions and monitoring procedures.