Wireless Sensor Networks to Control Radiation Levels

The creation of the Radiation Sensor Board has been motivated by the nuclear disaster in Fukushima after the unfortunate earthquake and tsunami struck Japan. We want to help authorities and security forces to measure the levels of radiation of the affected zones without compromising the life of the workers. For this reason we have created an autonomous battery powered Geiger Counter which can read the radiation levels automatically and send the information in real time using wireless technologies like ZigBee and GPRS.

The design of the sensor board is open hardware and the source code is released under GPL.

The idea is simple, each node acts as an autonomous and wireless Geiger Counter. It measures the number of counts per minute detected by the Geiger tube and send this value using ZigBee and GPRS protocols to the control point. The system is powered with high-load internal batteries what ensures a lifetime of years.

With this technology radiation measurements can be known in real time without compromising the life of the security corps members as they do not have to be inside the security perimeter in order to activate the Geiger counters. The information is extracted automatically and sent wirelessly to the Gateway of the network.

Prevention and Control Radiation Sensor Network

The Prevention and Control Radiation Sensor Network is formed by dozens of sensor

devices deployed in the surroundings of the nuclear power plant and reaching the closest cities. Sensor nodes are installed in street lights and threes and take power from the internal battery which, at the same time is recharged using a small solar panel giving unlimited lifetime to the system. The nodes read the value of the Geiger tube during an specific time interval and calculate the number of counts per minute which are generated by the interaction of the radioactive particles. Then this value is sent using the ZigBee radio to the Gateway of the network which stores the information in an Internet data base.

Emergency Radiation Sensor Network

If a radiation leakage occurs in a place where there is not a previously installed radiation sensor network, an emergency deployment can be done in just a couple of hours. Security corps just need to spread the sensor nodes on the ground at certain places. Sensor nodes will take the power from special high load internal batteries which will ensure the control network to be working for months. Each of these points will send the information by using a TCP/IP connexion through the GPRS network or sending SMS alarms when the values are over a certain threshold.

How the Radiation Sensor Network works

Waspmote has a cyclic behaviour. It sleeps most of the time in order to save battery. At specific intervals it wakes up and during 1 minute reads the pulses which are being generated in the Geiger tube calculating the counts per minute. Then it compares this value with the alarm thresholds already predefined. If normal values are found they are sent using the ZigBee radio to Meshlium, the Gateway of the network and the values stored in an Internet data base.

If the values are above the security threshold defined, as well as being sent through the ZigBee network they are also directly transmitted to the security corps by an SMS alarm with the GPRS radio or event directly sent to the Internet via a TCP/IP socket.

Along with the value extracted from the Geiger counter, Waspmote adds also the GPS information (latitude, longitude) in order to give the exact location of the radiation source.

Particles detected by the Radiation Sensor Board

The Geiger tube integrated in the Radiation Sensor Board is sensible to Beta and Gamma particles as they can be detected in a ommnidirectional way. This means that no matter the orientation of the Geiger sensor respect from the source of radioactivity, just the distance. For this reason we ensure that setting the nodes in the right places is the key in order to detect a possible leakage from the Nuclear Power plant.

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