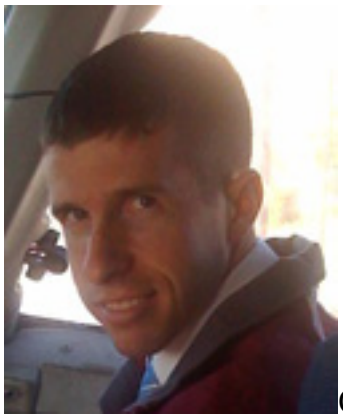
NI deploys LabVIEW and CompactRIO in wake of Fukushima nuclear disaster

Jason Lomberg, Technical Editor



One of the more unique applications of National Instruments' LabVIEW design platform was its recent deployment during the Fukushima nuclear disaster. In conjunction with Kyoto University, NI created the Kyoto University RAdiation MApping (KURAMA) system and its successor, KURAMA II, which measured gamma rays in the Fukushima Prefecture. At NI Week 2012, I learned more about this intriguing development.

On March 11, 2011, a magnitude 9.0 underwater megathrust earthquake devastated the Pacific coast of Tōhoku, taking a catastrophic human toll — 15,867 deaths, 6,109 injured, and 2,909 people missing — and causing a series of nuclear accidents, including level 7 meltdowns at the Fukushima No. 1 nuclear reactor plant.

While there were no deaths directly attributable to radiation exposure, the long-term health effects were more ambiguous. NPR science correspondent Richard Harris noted [1] that "any potential health risk is too small to measure"; conversely, Princeton Professor Frank N. von Hippel wrote [2] that "one might expect around 1,000 extra cancer deaths related to the Fukushima Daiichi accident."

As is custom, politics followed closely in the wake of disaster, and critics — including non-governmental organizations and nuclear watchdog groups — used Fukushima to further their anti-nuclear agenda.

The Japan Times wrote that "By shattering the government's long-pitched safety myth about nuclear power, the crisis dramatically raised public awareness about energy use and sparked strong anti-nuclear sentiment."

Naoto Kan, Japan's reigning Prime Minister during the Fukushima disaster, said that "Japan needs to dramatically reduce its dependence on nuclear power, which supplied 30% of its electricity before the crisis."

But none of this political posturing helped the people on the ground, and that's

where NI and Kyoto University came in. A tense public prompted calls to measure the radiation within Fukushima Prefecture and to produce precise maps of air dose rates to understand the inhabitants' state of exposure and environmental considerations.

Using NI LabVIEW system design software and NI CompactRIO hardware, National Instruments and Kyoto University designed the KURAMA system, a radiation-monitoring device which — via a roving fleet of vehicles — continuously measured gamma rays in arbitrary locations.

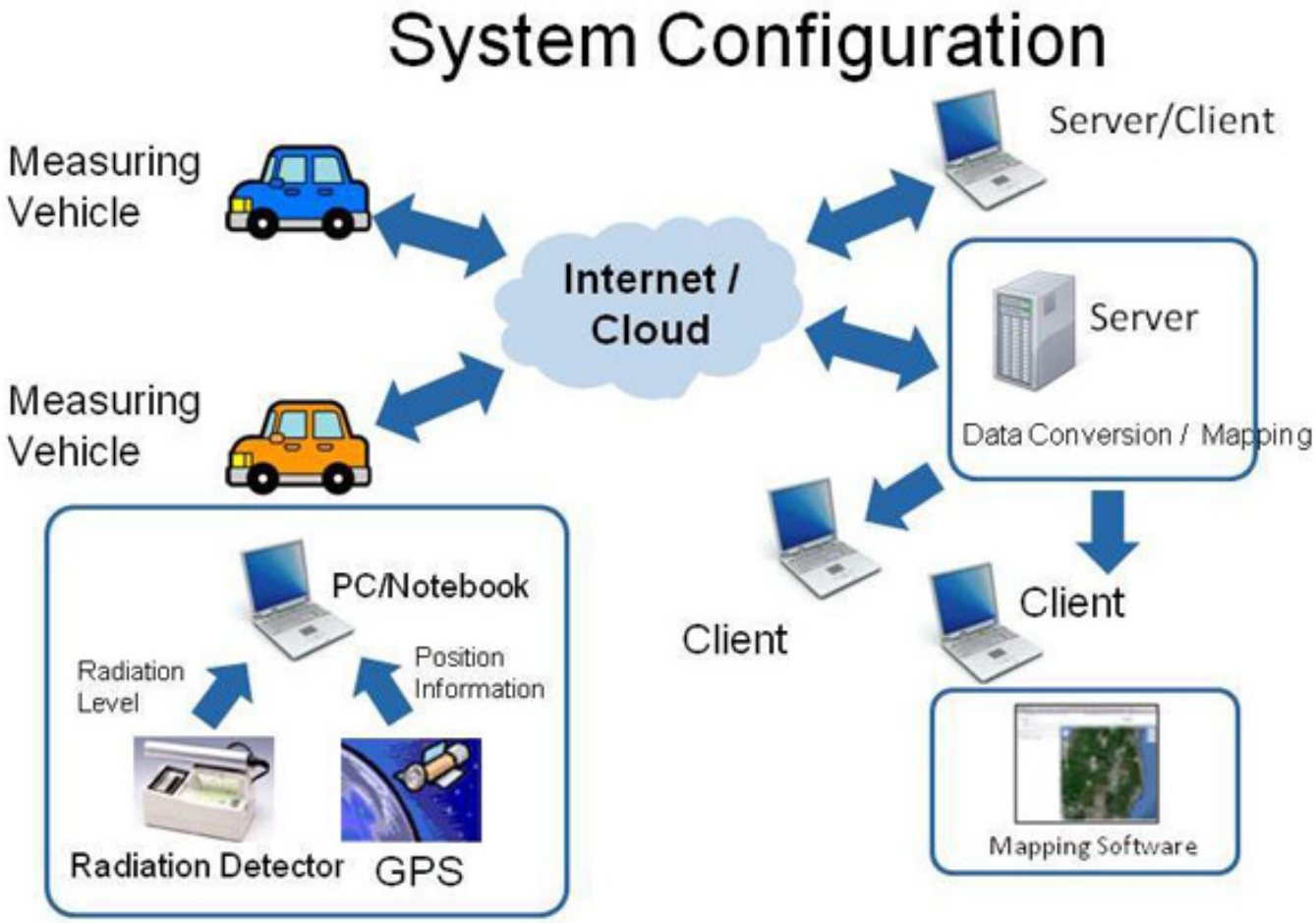


Figure 1. KURAMA's System Configuration

According to NI's case study [3], "Measurement times and locations are retrieved from the GPS, tagged to the corresponding measurements, and sent to servers through the Internet. A near real-time visualization of the area's radiation dose distribution is plotted on top of map data with the results."

They used a conventional passenger car as the measuring vehicle and a measurer operated the in-vehicle device.

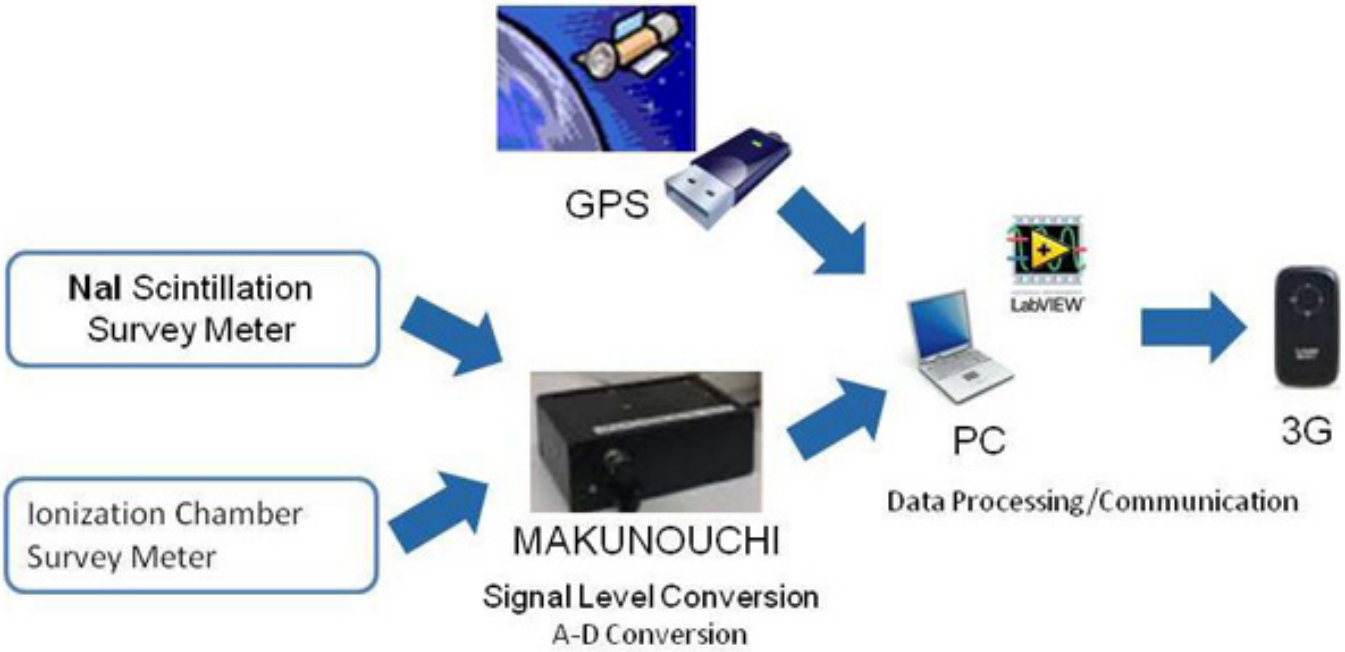


Figure 2. KURAMA's In-Vehicle Device Configuration

The KURAMA device performed admirably but contained notable flaws — principally, its unwieldy size. The team went back to the drawing board and came up with KURAMA II, which replaced the original device's interface box and computer with CompactRIO. As a result, KURAMA II was an abridged 34.5 cm by 17.5 cm by 19.5 cm and was fully automated, eliminating the need for an in-vehicle measurer.

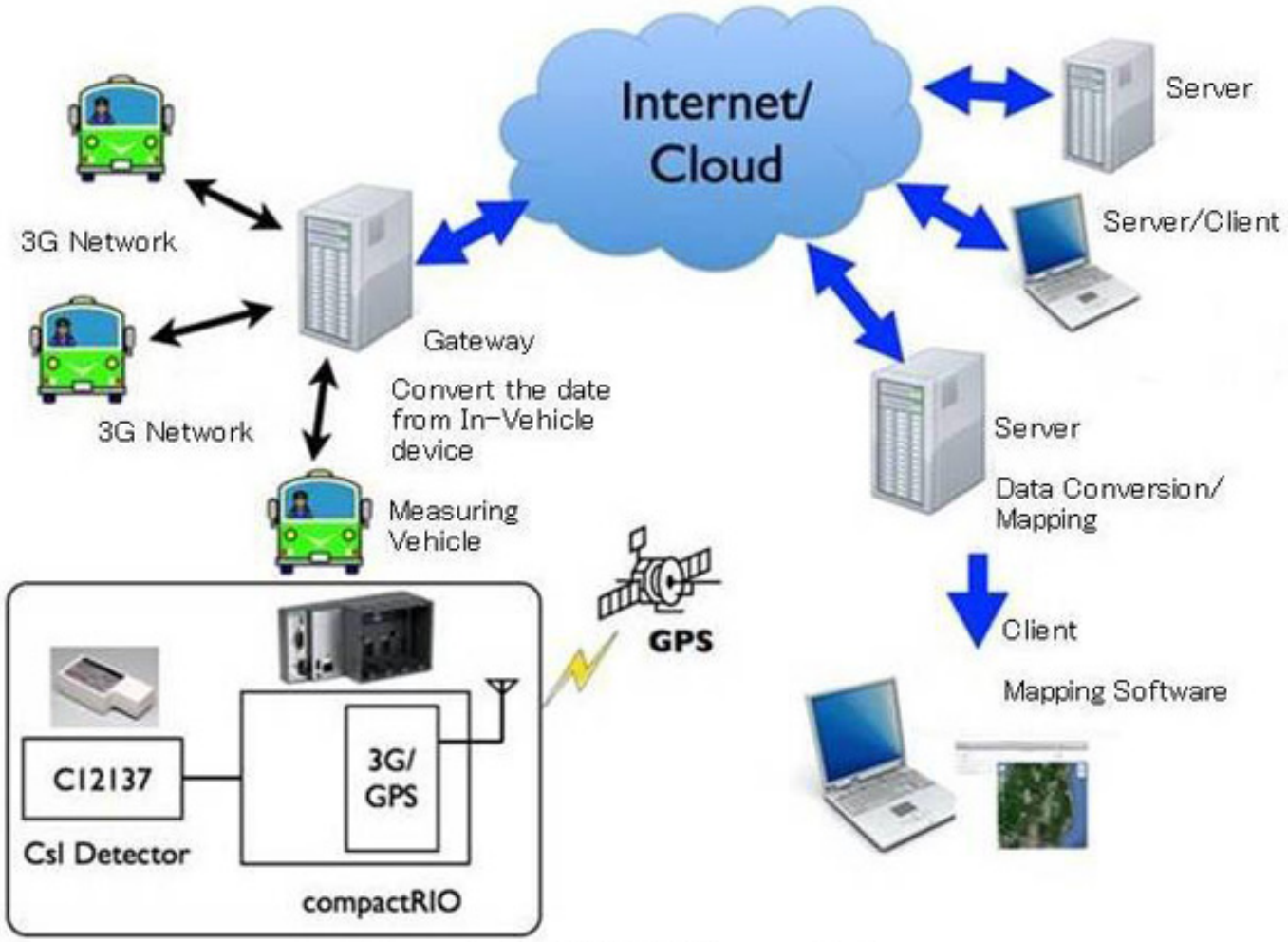


Figure 3. KURAMA-II's System Configuration

At NI Week 2012, members of the KURAMA team — including Dr. Minoru Tanigaki, assistant professor at Kyoto University — discussed the device's successful application. They noted that the KURAMA II acquired 4 million data points, a fruitful result to say the least.

ECN will be closely following this development along with any further news regarding the KURAMA platform.

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