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GNSS for Road

Why do we need standards to ensure that GNSS for road and infrastructure management projects don't go wrong?

Imagine we have just completed a project to implement a road or infrastructure management system. The position information is given by GPS and the networking and commercial aspects are handled by a number of carefully positioned fixed infrastructure point(s) and control centre(s). Each vehicle in the project has been equipped with a GPS system, with communications interface to transmit and receive information.

Our system could be used for congestion charging, road user charging, traffic management, driver monitoring purposes ... or any one of many similar applications.

Imagine also we have a problem. Our system does not work well enough:

- The accuracy of the GPS is not what we had been led to believe
- The users are saying they were not where their GPS reported them to be
- Invoices and information we have issued are being contested by users.

How can this be? GPS is accurate to a few metres, works just about everywhere outside, and the receivers we have used are the latest high sensitivity units.

Is this a surprising scenario to you? If yes, read on, because the reality is that careful planning, design and testing is required to ensure that GNSS-based systems will deliver satisfactory results in situations like this.

The core problem here is the extent to which the receiver position can be trusted. In other words, the integrity of the position information is the key issue.

Unfortunately, there are no generally accepted standards for performance of a GNSS receiver, including the integrity of the position information. There are a few exceptions (for example aspects of Assisted-GPS in mobile phones and emergency position requirements in North America (E911), but generally the lack of standards is a widespread reality in GNSS.

Because of this lack of standards, each project looking to use GNSS needs to develop its own performance criteria and test approaches. Anyone who has been involved in doing this will be aware that it's hard work and also requires expertise and experience to do well. There are many aspects to ensuring that system performance is appropriate in all areas while not driving up project costs or pushing out delivery time unduly. Without experience and insight it's easy to miss critical elements.

Of course, in some applications poor performance of the GNSS system is inconvenient rather than critical. For example, it's annoying when an in-car navigation system is not performing well, but the driver can compensate and usually the sat nav will "catch up" when conditions improve

In commercial or infrastructure management projects, however, the trustworthiness and integrity of the position information can make or break the system. As an example here, if drivers are being charged for using motorways, they would not expect to see a charge when travelling on parallel roads or when crossing the motorway. Equally well, the charging authority could not accept a system that gives the possibility of intentional abuse (eg. jamming) or unintentional problems (eg. interference).

A specific example I am aware of was a well-intentioned project to use the GPS position of busses to charge passengers' travel cards the appropriate amount based on where they got on and off. Within days of go-live the bus company was receiving complaints of incorrect fares. On investigation, the availability of acceptably accurate position information was too low in many parts of some routes. Also a continuous GPS position was not always available so the charging system was using the last available position which could be some way away.

These are just a examples of potential problems that might occur. In my opinion, industry (and I use this term in its widest sense, including government agencies) is crying out for some established approaches and guidance in this area. One challenge is who should take the lead on this?

There are several possible contenders:

- The Galileo project has a commercial focus and recognises that standards are important. Galileo is running events which will include discussion of standards (for example an application day www.application-days.eu).
- A German-led group, CERGAL (Certification Galileo) holds annual meetings to discuss mostly safety-critical aspects of GNSS. In recent CERGAL meetings there has been a focus on air, rail and maritime applications of GNSS. (www.dgon.de/content/cergal2010_cfp.php).
- There is a possible role for standards bodies such as ETSI, the European Telecommunications Standards Institute.
- In specific areas, for example the RCTM (maritime) and RTCA (aviation), standards bodies have taken an interest in aligning and improving GNSS standards.
- Manufacturers have an interest in developing proprietary standards, but usually these focus more on receiver performance than integrated system performance.

The concern is that without some concerted action involving the interested agencies and parties, GNSS standards will evolve through a "needs must" approach in an uncontrolled manner. At best this will result in some winners (who get things right) and some losers (who waste money and get frustrated). At worst, there will be many losers and GNSS technology will become discredited. That, in my opinion, would be a great shame.

Let's hope that some solutions will emerge to the benefit of all concerned! Through this year I will continue my column focusing on some of these aspects.

I invite you to think about the challenges and consider how you can positively impact developments in these areas.