Automotive applications of high precision and robust GNSS

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Over the next decade, the growth in Global Navigation Satellite Systems (GNSS) through the development of new signals and the deployment of new satellite constellations will provide greater positioning and navigation capability for wide Intelligent Transportation Systems and Services (ITSS) applications. With increased environmental and safety concerns which creates further demand for ITSS applications, such as congestion reduction, collision avoidance, fleet management, highway inventory management, road user charging and autonomous driving, there is a need for centimetre level accuracy positioning provided in real-time under dynamic conditions. In transportation scenarios, this has been shown to be possible using existing technologies and solutions, but with particular drawbacks in accuracy, mobility, continuity, availability and integrity.

Many of the barriers to the adoption of GNSS for ITSS applications still need to be resolved. Centimetre level precision can be achieved using traditional Real-Time Kinematic (RTK) positioning techniques, but mobility is limited. Well-known problems exist with dynamic positioning in heavily built up or sheltered areas, such as in dense urban or forested regions, causing a discontinuity of the positioning solution. Most ITSS applications involve either autonomous active control of a vehicle or a passive system providing information to the driver, both of which demand high levels of reliability and integrity, otherwise the systems would lack reliability and not be adopted. Finally, some applications require widespread availability of positioning systems onboard vehicles, so any such system would need to be cost-effective and intrinsically simple.

One such positioning solution is Network RTK (NRTK), as this can provide wide mobility and consistency. There are many systems in place across the world, reducing the initial infrastructure set up costs, and which could allow the rapid adoption of the technology into ITSS applications.

Figure 1. The testing facilities at MIRA Ltd.

This project will focus on the exploitation of modernised GNSS high precision and robust positioning designed for ITSS applications. Through the testing of GNSS robustness in dynamic environments, the development and testing of communication or positioning correction information, and the integration and augmentation with other positioning sensors, a prototype system is to be developed. Testing of the prototype system will be carried out at MIRA's new innovITS ADVANCE ITSS test track in the UK as shown in Figure 1, which offers real world testing scenarios with various road layouts, and junctions with signal heads. The infrastructure includes GNSS denial systems, ground truth systems, as well as configurable wireless and 3G communication networks. Figure 2 shows the dedicated survey van for ITSS research and development that will be used extensively in various tests.

Figure 2. The most advanced ITSS test vehicle.