RENAISSANCE AND
NEW TRANSPORT SYSTEMS

Comune di Perugia

10 settembre 2010 - Perugia, Palazzo dei Priori, Sala dei Notari

Feasibility Study into Potential transport applications of the Galileo satellite system in the historic city of Bath

Dr Robert Shepherd
ACIS

Abstract

The European Galileo global satellite navigation system will provide services that offer increased accuracies over what is currently possible using GPS. With years of experience in the industry of applying GPS technology to real-time passenger information services, the paper discusses the practical impact of the poor GPS performance in the urban area on public transportation systems.

From this baseline, the feasibility of a number of application areas where Galileo is expected to act as a significant enabler is discussed. The application areas include both real-time passenger information and Intelligent Transportation Systems, where the technology can be used for the benefit of the wider travelling public. Specific real-time passenger information examples given are management of services down urban corridors, dynamic management of bus stations, incident management and traffic signal priority. The Intelligent Transportation examples include the opportunities presented by data fusion and data sharing along with positional information.

The development of a Galileo capable on-vehicle computer for real-time passenger information applications is described along with the results of a trial within the United Kingdom using EGNOS, the European satellite positioning augmentation system that is currently operational in conjunction with GPS.

Finally, comparative results for the on-vehicle computer with some older GPS receiving equipment are presented.

Biographical Summary

Robert Shepherd is a founder member of ACIS's Systems Engineering Group based at the company's R&D headquarters in Cambridge. His role includes that of technical consultant on communications systems and traffic signal control systems. Since joining ACIS is 2006 he has worked on a variety of Intelligent Transportation System projects, including:

- *A new infrastructure control software to provide advanced communications features into ACIS's Belfast system, where driver security is a paramount consideration.*
- *Devised a means of utilising limited real-estate within a bus station to maximise the throughput by allocating bays dynamically.*
- *Design of a high performance real-time intelligent Data Warehouse for the UK Department of Transport FITS Freeflow project, which is providing an Intelligent Transportation System solution based on UTMC.*

Prior to joining ACIS, Robert has extensive experience in wireless communications and transportation systems worldwide. During over 20 years in the industry Robert has worked on a diverse variety of systems including 3G end user Quality of Experience, System Architecture for wireless systems, GSM-R for railways, air traffic control communications systems and UK motorway communications systems.

Robert holds a B.Sc in Physics from Imperial College, London and a Ph.D in Atomic Physics from the University of Kent.

RENAISSANCE AND NEW TRANSPORT SYSTEMS

Comune di Perugia

10 settembre 2010 - Perugia, Palazzo dei Priori, Sala dei Notari

Summary of Paper

The Galileo programme is Europe's initiative for a state-of-the-art global satellite navigation system, providing a highly accurate, guaranteed global positioning service under civilian control. The paper discusses the application of the accurate Galileo positioning services to the urban environment. The work described herein is from the Civitas Renaissance project measure 8.2 to study transport applications of the Galileo satellite system in the historic city of Bath.

Unfortunately, the delay to the commercial availability of Galileo services has resulted in the original aims of the project not being attainable within the timescales of the programme and this specific measure is being curtailed after year 2.

The context for the paper is the application of positioning information to public transportation systems, and a brief introduction to real-time passenger information systems is presented.

Given that satellite positioning systems, e.g. GPS, already exist, the limitations of GPS accuracy are discussed using the example of an urban canyon. This example demonstrates some shortcomings of the current GPS system, which was one of the motivators for the current project.

There are a number of applications where improved positional accuracy will benefit the operation of real-time passenger information systems, and as a result improve the quality of experience for the travelling public.

Following a brief introduction to real-time passenger information systems, we focus on the feasibility of improvements in the urban area, such as traffic corridors, where bus services from out of town pass down common roads into the town or city centre. By effectively managing such services in real-time, within the town or city boundaries passengers can benefit from a frequent service based on headway and not schedules, whereas passengers from outside the town or city using the individual services, which are individually less frequent, benefit from accurate information.

Within towns and cities the space available for bus stations can be severely limited; this is often acute in historic cities where any redevelopment may be prohibited. This may be a barrier to improvements in bus services, as only a limited number of journeys may be possible. By using real-time tracking of vehicles, we introduce the concept of a dynamic bus station, which actively manages the available real-estate to maximize the number of services using the bus station.

A further example of how improvements to positional information can assist is found by considering incident management. Whilst the primary emphasis is on improved positional accuracy, it is seen here that the second theme of the paper, that of Intelligent Transportation Systems (ITS) starts to emerge. As with our final example for real-time passenger information, that of Traffic Signal Priority, there is the interchange of information with the ITS systems.

In the United Kingdom ITS systems are based around a standard for Urban Traffic Management and Control (UTMC). Following a brief introduction to UTMC, we note that the UTMC community is embracing positional information for monitoring traffic conditions within the urban environment.

The application of data fusion techniques, along with data sharing and the use of positional information within ITS systems provides the basis for a number of potential applications. These include the sharing of data to co-ordinate transportation activities between different users, whether they are public safety, freight or bus, the use of positional based sensors for ITS systems and where accurate positional information is seen as being applied in ITS.

ACIS has developed a Galileo capable platform for use as an on-vehicle computer for real-time passenger information applications. With reference to the requirements of the UK Real-Time Information Group (RTIG) National Architecture for on-vehicle architecture, the paper briefly discusses the design and development of the platform. The platform has been trialed in the UK and New Zealand, and results of positional measurements from the UK trial are given.

The results presented are from both a UK trial of the platform, which is suitable for comparison with the earlier urban canyon example, and a specific comparative test run to provide a direct comparison between earlier GPS receivers, and current GPS receivers where the positional accuracy is enhanced by EGNOS augmentation services.

From this we conclude the benefits of being able to use Galileo based positional services in the future.