Segurmovil. Automatic vehicle locating

Tomás Agrelo
SEGURMAP

The use of satellite-based positioning systems has become more widespread in the last few years due to two key factors: their characteristics (precision) and their economy (the signals which are used are freely accessible). Great market expectations have been aroused: navigation systems, fleet management, location of vehicles, emergency services, telecommunications, etc.

PRESENTATION

Seguridad Mapfre, S.A. (SEGURMAP) is a service company which is specialised in the installation and maintenance of electronic security systems. The company also has a 24 hour alarm monitoring centre.

In order to ensure the safety of mobile assets (vehicles, trucks, motorcycles etc.) SEGURMAP developed the SEGURMOVIL system, based on the new communication (GSM) and positioning technologies (GPS).

Basically, SEGURMOVIL allows the location of a vehicle to be automatically determined after the occurrence of an event affecting that vehicle, or this may also be done manually from the vehicle itself or from the control centre.

DESCRIPTION OF SEGURMOVIL

A vehicle which has the SEGURMOVIL system always has its position tracked by a control centre. The control centre basically consists of a server with databases of digitised maps and a communications manager. If, for example, a thief were to steal a vehicle, the SEGURMOVIL system would automatically send a theft alarm signal to the control centre together with the position of the vehicle. From that moment on the vehicle would send its position every minute, in other words the thief's attempts to steal the vehicle would be actually be drawing its trajectory on the map in the control centre. As the position of the vehicle is known in real time, its recovery would be an easy task.

SEGURMOVIL is not however simply a vehicle locator in case of theft. SEGURMOVIL is designed to be a complete security system for the driver, making it possible to send alarm signals in the case of collision (automatically), mechanical breakdown or an SOS alarm, apart from sending short messages from the control centre or from another GSM if it is enabled to do so. In this way the vehicle's driver knows that the position of his car is constantly monitored and he or she will thus feel safer.

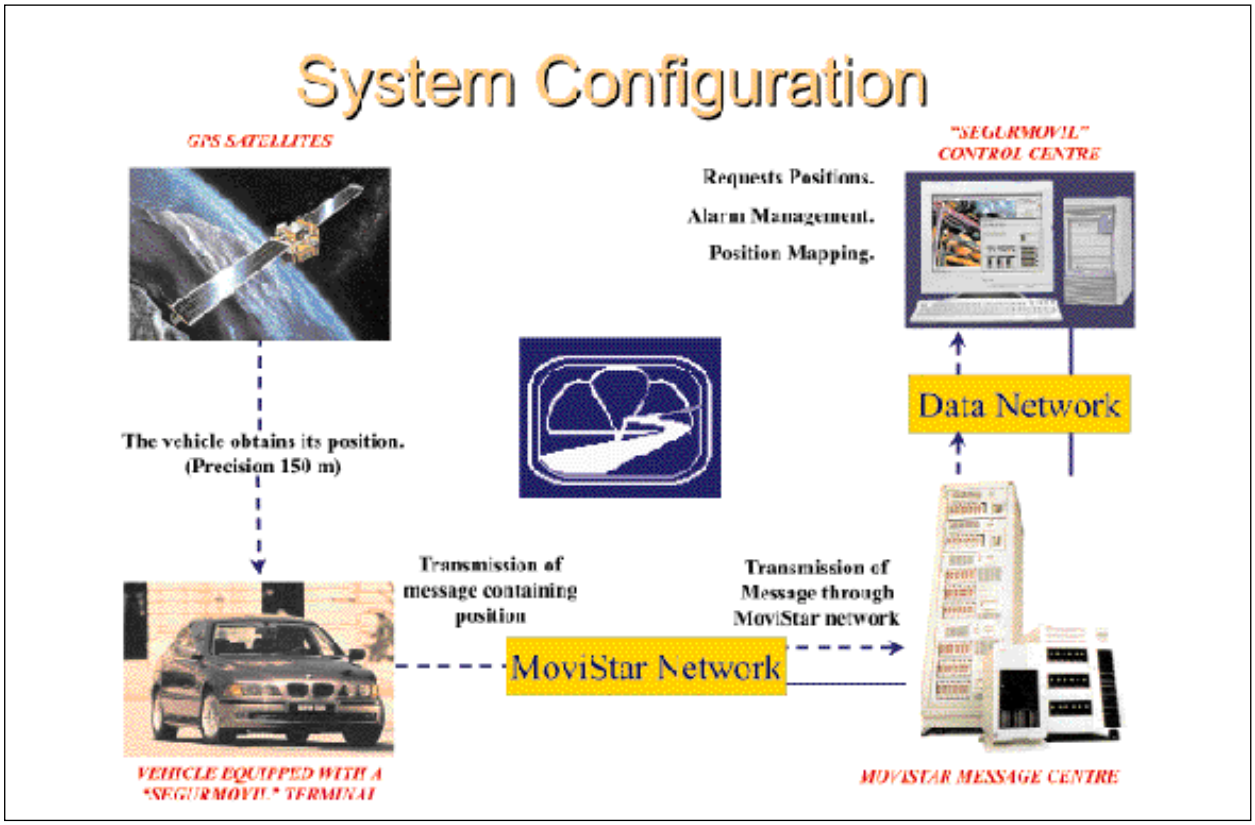
The above paragraph outlines what would be the most basic functionality of the system, in other words that which might be required by a private vehicle. The SEGURMOVIL system can however also work as a control and management system for use with fleets of vehicles.

The system is capable of monitoring a vehicle at regular intervals of time which have been set by the control centre. It is therefore possible to use resources with much greater flexibility, which would lead to cost savings and greater service efficiency.

It is possible to visualise the route of a vehicle in real or deferred time or to request its position at any given time. It is also possible to see the position of all the vehicles in the fleet and use this information to make decisions in real time according to the needs and circumstances of each moment.

The system also permits one to know the speed and distance travelled of any particular vehicle and to compile a record of the kilometres travelled each month for posterior analysis.

It is possible to send text messages from the control centre or from other GSM terminals if this has been authorised by the control centre.



One is also able to determine the current operational state of the vehicle, engine running or stopped.

In addition to these characteristics, the system is able to grow in order to adapt itself to the requirements of any fleet, greatly expanding the system's range of possibilities.

THE TECHNOLOGY

The very latest technologies are used in terms of positioning (GPS receiver), communications (GSM modules) and control (RISC microprocessors).

The GPS system (Global Positioning System) was the catalyst which gave rise to innumerable applications which only a decade ago would have been unimaginable. In time-dependent applications it is used as a source of synchronisation (obtaining precisions of better than 1 microsecond). Positioning applications are however the most common, and permit the position of a mobile object to be ascertained at any time and place with a precision of some 15m.

The use of satellite-based positioning systems has become more widespread in the last few years due to two key factors: their characteristics (precision) and their economy (the signals which are used are freely accessible). Great market expectations have been aroused: navigation systems, fleet management, location of vehicles, emergency services, telecommunications, etc.

The GPS system is run by the United States Defence Department and is made up of 24 satellites which are distributed in six polar orbits around the earth. These emit constant electromagnetic signals in the L band (L1 and L2) which are then captured by a receiver. These signals carry the information relating to the position of the satellite and time of transmission, and using this information the receiver is able to determine its position by calculating its distance from various of these satellites (four satellites would be needed in order to give a three dimensional position).

The GSM system is a pan-European standard for digital cellular mobile telephones making it very suitable for this application due to its «roaming« characteristics (the automatic transferral of control when moving from one cell to another within the network) throughout the countries which implement this service, removing the incompatibilities which traditionally existed between different national mobile telephone systems.

The SMS (short messaging service) facility which is offered by the GSM network is used to establish communication. This involves the transmission/reception of messages of up to 160 alphanumeric characters. The SMS service does not use radio channels nor does it use up network resources with the consequence that transmission costs are low.

The RISC microprocessors which are used belong to the Microchip 16Cxx and 17Cxx family. They have Harvard type architecture with separate memory for data and programmes. Access to each of these memories is carried out through separate buses, this leads to bandwidth improvements over the traditional Von Neuman architecture.

Data words have a length of eight bits whilst instruction code has a length of 16 bits. Programme memory is internal although external memory may also be assigned. Another important characteristic is that the search and execution cycles of an instruction are overlapping, leading to a twofold increase in processing speed.

THE PRODUCT

Before being launched onto the market the SEGURMOVIL system went through a long period of successful testing. As a result of this, SEGURMAP is able to offer a product of proven quality at a completely accessible price. Our product is today a tangible and widely tested reality.

SEGURMAP has installed various hundred units of the SEGURMOVIL system. Installations have been carried out in all types of vehicles, especially in medium to high range vehicles.

Installed equipment

The mobile terminals which are installed in the vehicles have been designed and manufactured by SEGURMAP, and the GSM module, the GPS receiver and the control and storage module had been integrated into a single unit:

Main Unit:

This consists of the following elements:

- Positioning module, this is made up of a GPS antenna and receiver which provide the geographical position co-ordinates.
- GSM communications module including the SMS short messaging facility and which serves as the interface with the communications system.
- Control processing and storage module. This contains a CPU with two RISC architecture microcontrollers and storage memory.

Transblocker or immobiliser. This device blocks the engine at various points. Before starting the vehicle users must identify themselves with a coded key (this has a user code stored in a memory), this code is read by the Transblocker and only if the codes agree can the vehicle the started.

Display/keyboard. These two elements are included in the same case. The display is an LCD screen which allows the user to see text messages. The keyboard has five buttons which allow the user to send up to three different alarm messages to the control centre. The other two buttons are auxiliary and allow for the confirmation of the alarm signals and to scroll through the screen.

Impact sensor. This is an inertia switch which makes contact in the case of deceleration due to a collision.

Control Centre

The control centre is modular and arranged with a PC type architecture, it is based on operator positions, a server with geographical and alphanumeric data bases and a communications manager. The network server contains geographical data on all of Spain, including street plans of towns of more than 25 thousand inhabitants.

The computer system is designed with a «window« software architecture, allowing an operator to see one area and to simultaneously follow a vehicle in detail on another map. It offers a visual environment which is fast to learn and use.

The system also has tools which allow for the optimisation of routes and the management of fleets. The computer software is completely versatile, adaptable and customisable for any user environment and it uses the latest technologies for the handling of graphical information.

The software architecture is completely modular, allowing total flexibility to include specific functionalities for each user environment. Its modular characteristics allow made-to-measure systems to be configured and permit practically unlimited growth. ■