The consistency of the measurements can also be checked using digital watermarking techniques notably allowing the terminals to locate the transmitters of a network. This technique is often referred to by the word "watermarking". An example of the use of digital watermarking is disclosed in the patent application WO 2009/037133.

Moreover, securing location applications assumes known anti-tampering protection measures in the securing of the exchanges and in the protection of data coming from other sensors in the vehicle.

Such methods are not at present implemented in commercially available receivers and some of them assume high cost resulting from re-design work at chip and/or control software level. In particular, redesigning the chip for mass produced receivers represents a high cost and a long delay. Other methods assume the adding of sensors in the mobile equipment (inertial, measurement of radio-frequency signals). In any case, they are not guaranteed and sophisticated attacks can at least partially bypass them.

The idea used by the present invention, unlike the existing approaches of the prior art which generally demand the adding of secondary position information or a more elaborate processing of the signal in the GNSS reception, notably consists in using cartographic information, without calling upon other sensors, in the case of normal functioning of the device.

The subject of the invention relates to a method for authenticating the position X(t) of a mobile element, a mobile element comprising at least a GNSS receiver, ~~k~~ r, having a function of estimating the position X(t) of that mobile element, this method being characterized in that it comprises, in combination, at least the following steps:

- determining one or more items of data associated with the position X(t) of a GNSS receiver, r,
- extracting reference data associated with the position X(t) from a cartographic database,

- determining at least one consistency indicator Ic(X) using the first item of data associated with the said receiver r and the reference data coming from the cartographic database,
- filtering the said indicator or indicators Ic(X), in order to improve the detection rate or the false alarm rate,
- authenticating the position X(t) of the said mobile element using one or more of the said consistency indicators Ic(X) in an authenticity decision function.

The filtering step is, for example, carried out by temporal integration of the indicator over a given period of time.

The establishment of the cartographic database and the calculation of the consistency indicator are carried out in a centralized device connected by a communications network to the said mobile elements.

The establishment of the cartographic database and the calculation of the consistency indicator are, for example, carried out within the said mobile elements.

According to a variant embodiment, in order to authenticate the position X(t) of a mobile element, the consistency indicator Ic(X) is calculated from the position of pseudolites indicated in the cartographic database.

In order to authenticate the position X(t) of a mobile element, the consistency indicator Ic(X) can be calculated from the direction or directions θ_{map1}, θ_{map2} of the road segment travelled and/or the speed V_{map} estimated over this segment, from data indicated in the cartographic database.

According to another embodiment, in order to authenticate the position X(t) of a mobile element, the consistency indicator Ic(X) is calculated from, on the one hand, the distance travelled $D_r(t)$, estimated by the measured speed $V_r(t)$, and on the other hand the distance as the bird flies D_{map}, or the curvilinear distance on the road graph in the cartographic database.

In order to authenticate the position X(t) of a mobile element, the consistency indicator Ic(X) is calculated, for example, from the measured altitude z_r, compared with that z_{map} indicated in the cartographic database ~~(23)~~.

Claims

1 – Method for authenticating the position X(t) of a mobile element (1), a mobile element comprising at least a GNSS receiver, r, having a function of estimating the position X(t) of that mobile element (1), this method being characterized in that it comprises, in combination, at least the following steps:

- determining one or more items of data (21) associated with the position X(t) of the GNSS receiver, r,
- extracting reference data associated with the position X(t) of the said mobile element (1) from a map or road map cartographic database (23),
- determining at least one consistency indicator (22) Ic(X) using the first item of data associated with the said receiver r and the reference data coming from the cartographic database,
- filtering the said indicator or indicators Ic(X), in order to improve the detection rate or the false alarm rate,
- authenticating (24) the position X(t) of the said mobile element (1) using the result obtained by application of an authenticity decision function to one or more of the said consistency indicators Ic(X).

2 – Method according to Claim 1, characterized in that the filtering step is a temporal integration of the indicator over a given period of time.

3 – Method according to Claim 1, characterized in that the establishment of the cartographic database (23) and the calculation of the consistency indicator are carried out in a centralized device connected by a communications network to the said mobile elements (1).

4 – Method according to Claim 1, characterized in that the establishment of the cartographic database (23) and the calculation of the consistency indicator are carried out within the said mobile elements (1).