

Method of authenticating position with the aid of photographs.

The present invention relates to a method of authenticating the position of a user of a navigation system and/or of services accessible as a function of geographical position.

More precisely, the method according to the invention pursues a dual objective. Firstly, the method according to the invention makes it possible to authenticate the position of a user of a positioning system, which is satellite-based for example, even though said position can be counterfeited, i.e. fraudulently, by a third party who emits falsified positioning messages, or by the user himself who communicates an erroneous position. This may for example be implemented, for fraud purposes notably, in the context of services accessible in certain geographical areas only. Secondly, the method according to the invention may make it possible to detect an erroneous position established by a navigation system, because of poor quality of satellite reception for example.

Thus, in the context of a user furnished with a device able to communicate his position, the general problem resides in the way in which it would be possible to authenticate the position communicated by the user's device. If same uses the positioning signals emitted by a satellite-based positioning system, a known solution would be to use hardened, encrypted signals that are almost impossible to counterfeit. But, on the one hand, it is not conceded that a current or future satellite positioning system is able to provide hardened positioning signals such as these. Moreover, in constrained environments in which satellite reception is poor, the number of visible satellites would potentially not be sufficient to allow authentication of the user's position. A solution consists in providing the user with a hardened device intended to communicate his position, but according to the prior art, this would involve an excessively constraining and expensive implementation, for commercial operators and for users alike.

To solve the general technical problem in an original manner, the present invention consequently proposes to use a photograph-taking capability carried by the user to take one or more photographs of the user's environment in proximity to the position to be authenticated. The method
5 according to the invention then proposes to compare this or these photographs with at least one reference photograph, georeferenced in a definite manner, and corresponding to the geographical position communicated by the user.

10 Thus, the subject of the invention is a method of authenticating a real geographical position of a user, a theoretical geographical position of the user being provided by a navigation system or by said user, with the aid of a database comprising a set of georeferenced photographs, said user being furnished with a device able to take photographs, characterized in that said
15 authentication method comprises:

- a first step of taking at least one photograph of the user's environment performed at a random instant and in proximity to the real geographical position to be authenticated,
- a second step of comparing said photograph taken with at least
20 one reference photograph chosen from the database and corresponding to the theoretical geographical position, so as to authenticate the theoretical geographical position provided as being the user's real geographical position if said photograph taken corresponds to said reference photograph, or to declare said theoretical geographical position invalid in the converse
25 case.

The discrete and random natures of the taking of photographs are aimed notably at enhancing the security of the position authentication.

According to a variant of the invention, during the first step, said photograph is encrypted.

30 According to a variant of the invention, during the first step, said photograph is taken in an anonymous manner, in such a way that the user is not identified.

According to a variant of the invention, during the second step, the comparing of said photograph taken with said reference photograph
35 comprises an algorithm comprising a first phase of defining a set of

characteristic points of said photograph taken and of said reference photograph and a second phase of comparing said characteristic points of said photograph taken with said characteristic points of said reference photograph.

5 According to a variant of the invention, during the second step, the comparing of said photograph taken with said reference photograph comprises a learning phase.

 According to a variant of the invention, the database comprises a set of photographs taken in a random manner by a set of users.

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Other characteristics and advantages of the invention will become apparent with the aid of the description which follows given with regard to the appended drawings which represent:

- 15 • Figure 1: the diagram of an exemplary photograph taken in proximity to the theoretical geographical position to be authenticated;
- Figure 2: the diagram of an exemplary reference photograph of the user's real geographical position.

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The invention makes it possible to solve the problem of counterfeited positions, notably within the framework of a satellite-based positioning system whose positions provided would be intentionally falsified, by said users or by third parties.

25 In particular, such subterfuges will probably be increasingly frequent in the context of pay services from certain geographical areas or geographical toll areas.

 The present invention makes it possible to authenticate a position in a simple manner, circumventing the necessity to produce totally hardened reception boxes for users or to have hardened positioning signals be emitted to navigation systems.

30 The proposed solution consists in taking a photograph of the environment of the user whose position is required to be authenticated with the aid of an integrated apparatus carried by the user. One or more
35 photographs is taken when the user is in proximity to the geographical

position to be authenticated. The exact instant of the photograph taking is preferably pseudo-random, so that the user may not anticipate the exact position at which said photograph is taken. In the method according to the invention, the photograph or photographs taken is/are thereafter associated
5 with the user's theoretical geographical position.

In order to avoid any falsification subsequent to photograph taking, the photograph or photographs taken and the theoretical geographical position will be able to be encrypted.

The invention thereafter comprises a step of comparing said
10 photograph or photographs taken with at least one reference photograph. The method according to the invention utilizes a database comprising a set of georeferenced reference photographs, that is to say whose geographical coordinates are known. These reference photographs may have been obtained through specific programs of surveys and/or through the use of the
15 set of photographs taken in a pseudo-random manner by the set of users, and whose geographical position has already been authenticated.

According to a preferred mode of implementation of the method according to the invention, the photograph or photographs taken by an integrated box carried by the user are taken without the knowledge of said
20 user. The utilization of this or of these photographs may be anonymous, that is to say it need not be associated with the identity of a user.

In order to compare the photograph or photographs taken with at least one georeferenced reference photograph, the method according to the invention envisages the use of known algorithms for image recognition. Thus,
25 preferably, the step of comparing the photograph or photographs taken with at least one georeferenced reference photograph comprises a step of defining characteristic points in each photograph taken and in each reference photograph and a step of comparing said characteristic points, respectively of the photograph or photographs taken and of the reference photograph or
30 photographs.

Thus, for a user situated at a real geographical position, the integrated box that he carries snaps a photograph such as shown diagrammatically in Figure 1 corresponding to said real position. If he communicates a theoretical geographical position for which the database
35 contains a reference photograph such as shown diagrammatically in Figure

2, the method according to the invention is able, by way of the implementation of image recognition algorithms, to declare the theoretical geographical position communicated by the user as invalid. These image recognition algorithms are indeed able to detect characteristic differences, notably by comparing characteristic points chosen at the level of the houses situated on the left of the images in Figures 1 and 2. On the contrary, if the user communicates his real geographical position, the method compares the photograph taken, shown diagrammatically in Figure 1, with a reference photograph similar to Figure 1; thus, the method according to the invention is able to authenticate the geographical position of the user.

To summarize, the invention has the main advantage of allowing the authentication of the position of a user of a navigation system in a simple and economical manner.

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CLAIMS

1. A method of authenticating a real geographical position of a user, with the aid of a database comprising a set of georeferenced photographs, said user being equipped with a device able to take photographs, characterized in that said authentication method comprises:

- obtaining a theoretical geographical position of the user from a navigation system or from said user;
- receiving from the device capable of taking photographs at least one photograph of the environment of the user, said at least one photograph being taken at random times close to the real geographical position to authenticate, so that the user cannot anticipate the exact position at which said photograph is taken;
- comparing said at least one photograph taken at random times to at least one georeferenced photograph of the database, said at least one georeferenced photograph corresponding to the obtained theoretical geographical position; and
- validating the obtained theoretical geographical position as being the real geographical position of the user if said at least one photograph taken at random times corresponds to said at least one georeferenced photograph, or invalidating said theoretical geographical position otherwise.

2. The method as claimed in claim 1, characterized in that, during the receiving step, said at least one photograph is encrypted.

3. The method as claimed in any one of claims 1 to 2, characterized in that, during the receiving step, said at least one photograph is taken in an anonymous manner, in such a way that the user is not identified.

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4. The method as claimed in any one of claims 1 to 3, characterized in that, the comparing step implements an algorithm comprising a first phase of defining a set of characteristic points of said at least one photograph taken and of the at least one georeferenced photograph, and a second phase of comparing the characteristic points of said at least one photograph taken with the characteristic points of the at least one georeferenced photograph.

5. The method as claimed in any one of claims 1 to 4, characterized in that, the comparing step comprises a learning phase.

6. The method as claimed in any one of claims 1 to 5, characterized in that the database comprises a set of photographs taken in a random manner by a set of users.