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## SYSTEM AND METHOD FOR OBJECT RECOGNITION INCLUDING ITS USE IN A MOTOR VEHICLE

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## SYSTEM AND METHOD FOR OBJECT RECOGNITION INCLUDING ITS USE IN A MOTOR VEHICLE AS A SEARCH AID TO ASSIST IN LOCATING OFFENDERS

Criminals often operate on a supra-regional basis. This means that different police authorities are responsible. It is therefore all the more important that information on crimes and criminals is exchanged and that the data is analysed centrally. Electronic data processing makes it possible to store, compare and analyse large amounts of personal and property data. With the files, connections between offenders and offences as well as criminal structures can be recognised and new investigative approaches can be gained.

It is standard for the police to identify people by their fingerprints. For some years now, other biometric methods<sup>1)</sup> have been available that can be used to identify persons. A distinction is made between static and dynamic, between cooperative and non-cooperative procedures. Static methods rely on the constancy of a characteristic; the property of not changing or changing only slightly over a longer period of time. Examples of this are, among others, the finger, the hand and the face. Dynamic methods rely on the recognition of changing characteristics such as pressure and movement. These can be, for example, the signature or the gait of a person. Cooperative methods require the cooperation of the person to be recognised: for example, placing a finger on a sensor. Non-cooperative methods can also be used without the knowledge and involvement of the person to be recognised. An example of this is facial recognition, which can also lead to recognition without the conscious presentation of the feature.

As the definition "measuring life" already suggests, biometric features are subject to a constant process of change. The same applies to the recording conditions. It follows that different images of a feature always differ somewhat from each other. The recognition of a person by means of biometrics works differently than recognition by means of a PIN or password. A simple right or wrong is impossible with biometric procedures. Rather, a degree of correspondence between the reference pattern stored in the system and the live recorded feature is required in order to recognise a person. This definable measure is called the threshold value. If the similarity of the recorded feature and the stored pattern exceeds this threshold, a person is recognised, otherwise the system assumes two different people.

A variety of biometric methods are now used for commercial purposes. For example, fingerprint recognition, iris recognition, speaker recognition, signature recognition, etc.

Facial recognition technology identifies people by features on the face that cannot be easily changed and are largely constant over time. Before a biometric system can recognise a person, the characteristics of that person must be recorded. This initial capture is also called enrolment. The data used for later comparison is stored in a special data format, the template.

Facial recognition is often used to compare a live image of a person with their stored template (e.g. in an access control system). This procedure, which serves to confirm a given identity, is called verification (1:1).

However, facial recognition systems are also able to compare all persons stored in the system with an image of an initially unknown person. In this case, one speaks of identification (1:n). Faces can also be extracted from the video stream of a camera and used as search images.

One approach to achieve improvements in face recognition is 3D face recognition. In this context, it is conceivable that a three-dimensional image of the suspect will be taken in the future during identification services. Head inclinations and rotations could be - at least partially - compensated for during later recognition by adapting the 3D model stored in a database to the angle of the 2D live recording.

Camera systems for object recognition in a motor vehicle are known, for example, from DE102013014210A1 and DE102018111239A1.

For example, DE102013014210A1 describes a vehicle with a display instrument arranged on a dashboard and a camera that can be at least temporarily directed towards an occupant of the vehicle. The (freely and pivotably mounted) camera (on the centre console) and the display instrument can be part of an in-vehicle video conferencing system.

DE102018111239A1 describes a camera system with different light sources for near and far field, which is used to operate an object recognition system with distance determination.

DE10151015A1 describes a method and device for monitoring the attention of a motor vehicle driver (inter alia by means of a camera directed at the driver).

It is therefore the **aim and object of the present invention** to provide an installation unit and a method which serve for object recognition and evaluation, in order to serve as a search aid to assist in finding criminals or detecting criminal offences.

In order to solve the above-mentioned task, an installation unit for a vehicle is proposed, comprising

- at least one camera directed at the driver (or several cameras directed at the passengers)
- at least one light source for illuminating the object to be examined
- a control unit for receiving the image information of the camera(s) and evaluating or sending the image information to a (police) database
- a method for assisting in the location of criminals or in the detection of criminal offences

**The procedure is outlined and described below using an example.**

A camera directed at the driver or occupant of a motor vehicle is selected in terms of the type of mounting, illumination, recording area, etc. so that it provides images and/or image sequences of the person to be observed which are suitable for facial recognition. These images are transmitted to a control unit, which itself or in conjunction with a server performs a comparison of the recorded images with a (police) database and performs an identification.

If this identification leads to a positive result (which means that the observed person is present in the database and is or was most likely connected to a criminal offence), the control unit automatically sends a message with special features to (at least) one police station (in the vicinity). The special features can be, among others:

- currently recorded image and/or image sequence with date/time stamp
- current vehicle position
- Data record from the database

With the help of this information, the police department itself can carry out another comparison and, if necessary, check the report for plausibility.

If the identification is confirmed by the police station and if, for example, an alert has been issued for the person concerned, the police station can send a message to the vehicle initiating permanent monitoring of the vehicle. This means that from this point on, the vehicle continuously transmits, among other things, the vehicle's position. Other features that can be taken from the vehicle (e.g. navigation destinations, telephone book entries, number of occupants, visual and/or acoustic contents, etc.) can also be transmitted to the police station.

An example will now be used to describe the usefulness of the invention:

A person for whom an alert has been issued is in a motor vehicle and is thus on the way to the national border, for example. A camera which monitors the passenger area can capture images or a sequence of images and transmit them to a control unit in the motor vehicle or outside the motor vehicle. The control unit can carry out verification or identification using image-processing algorithms for facial recognition, possibly with the aid of a database. If the passenger in the vehicle is identified as a wanted person, an automated message with specific information is sent to one or more police stations.

The police now have the opportunity to take the necessary further steps.

One conceivable embodiment of the invention could be that if a vehicle is equipped with such a system, it is not possible to move the vehicle or, if necessary, only to a limited extent if, for example, the camera(s) are covered. This is to prevent the system from being put out of operation.

In the case of an autonomous vehicle (level 4/5), it would be conceivable for the vehicle to navigate autonomously to a specific destination and for the person being searched to be "received" there by the police.

<sup>1)</sup> The term *biometrics* is derived from the Greek: *Bios* (life) and *Metron* (measure). It therefore refers to the measurement of living beings.