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# Automatic Vehicle Identification System.

The present invention relates to an automatic vehicle identification system for deciding whether or not motor vehicles can enter into specific areas such as toll roads, charged parking lots, etc.

Conventionally, in automatic vehicle identification systems, it has been so arranged that when a motor vehicle mounted with an identification (ID) plate having a characteristic ID number passes by a facility installed on a toll road, for example, an ID plate reader provided at a passage check point of a gate such as a toll collecting spot, automatic communication or automatic response is performed between the ID plate and the facility by a radio communication means as described in a magazine "Koutsuu Kougaku (Traffic Engineering)", Vol. 21, No. 2, pages 26-29 published in March, 1986 by Koutsuu Kougaku Kenkyukai of Japan. Thus, the characteristic ID number stored in or described on the ID plate mounted on the motor vehicle is identified by the facility and a necessary identification processing on the toll road, for example, a decision on a car model of the motor vehicle, automatic toll collection or a decision on permission of entry of the motor vehicle into a special zone is performed.

However, in the known automatic vehicle identification systems, it was possible to discriminate the characteristic ID number of the ID plate but it was impossible to

automatically decide whether or not the ID plate is mounted on a valid motor vehicle under contract. Namely, the known automatic vehicle identification systems have such a drawback that even if an ID plate allotted to a small-sized car in a contract for automatic toll collection of the toll road is illegally mounted on a large-sized car so as to reduce its toll, it is impossible to detect the illegal mounting of the ID plate on the large-sized car.

Accordingly, an essential object of the present invention is to provide a highly reliable automatic vehicle identification system capable of automatically deciding whether or not an ID plate is mounted on a valid motor vehicle under contract.

In order to accomplish this object of the present invention, an automatic vehicle identification system embodying the present invention comprises an identification plate for performing radio or optical transmission of a characteristic identification number and a vehicle number, which is mounted on a motor vehicle; an identification plate reader for receiving signals outputted from the identification plate so as to read the identification number and the vehicle number; a number plate reader for optically reading a number plate of the motor vehicle; and a comparator/collator for comparing a signal of the identification plate reader with a signal of the number plate reader. In use, if the comparator/collator has decided that the signal of the identification plate reader does not coincide with the signal of the number plate reader, movement of the motor vehicle may be regulated.

In the accompanying drawings:

Fig. 1 is a block diagram of an ID plate employed in an automatic vehicle identification system according to one embodiment of the present invention;

Fig. 2 is a block diagram of the automatic vehicle identification system of Fig. 1; and

Fig. 3 is a perspective view of facilities installed on a road, which are employed in the automatic vehicle identification system of Fig. 2.

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

Referring now to the drawings, there is shown in Fig. 2, an automatic vehicle identification system K according to one embodiment of the present invention. In Fig. 2,

the system K includes an identification (ID) plate reader 11 and a number plate reader 15. The ID plate reader 11 is constituted by a road antenna 12 installed on a toll road, a communication processor 13 and an ID number discriminator 14, which are connected to each other as shown. Meanwhile, the number plate reader 15 is constituted by a camera 16, an image processor 17 and a number plate discriminator 18, which are connected to each other as shown. The ID plate reader 11 and the number plate reader 15 are connected to a comparator/collator 19. The comparator/collator 19 is, in turn, connected to first and second communication controllers 20 and 21. Furthermore, the first communication controller 20 is connected to a fee calculator 22, while the second communication controller 21 is connected to an illegal traffic processor 23.

Operation of the system K of the above described arrangement is described, hereinbelow. An ID plate 24 shown in Fig. 1 is employed in the system K and is mounted on a motor vehicle 25 running on the toll road as shown in Fig. 3. In the ID plate reader 11, the road antenna 12 receives, by radio, data on the ID number from the ID plate 24 and the data on the ID number is transmitted via the communication processor 13 to the ID number discriminator 14. Data on a number plate 26 (Fig. 1) of the motor vehicle 25 such as a car model code, a 4-digit serial number, etc. is contained in at least a portion of the data on the ID number. The ID

number discriminator 14 discriminates the data on the ID number and the data on the number plate 26 so as to transmit the data on the number plate 26 to the comparator/collator 19.

In the number plate reader 15, the number plate 26 of the running motor vehicle 25 is shot by the camera 16 and the car model code, the 4-digit serial number, etc. in the data on the number plate 26 are discriminated through the image processor 17 by the number plate discriminator 18 so as to be transmitted to the comparator/collator 19. In the comparator/collator 19, the data on the number plate 26 transmitted from the ID number discriminator 14 is compared with and collated with that transmitted from the number plate discriminator 18 such that a decision is made as to whether or not the two data on the number plate 26 coincide with each other. If the comparator/collator 19 has made a positive decision that the two data on the number plate 26 coincide with each other, data for permitting passage of the motor vehicle 25 is transmitted by way of the first communication controller 20 to the fee calculator 22 in which a necessary fee corresponding to the car model code is calculated. On the other hand, if the comparator/collator 19 has made a negative decision that the two data on the number plate 26 do not coincide with each other, the negative decision is transmitted through the second communication controller 21 to the illegal traffic processor 23 by which a

necessary step such as closing of a gate of the toll road or taking a picture of the illegal motor vehicle 25 is taken.

Therefore, in the system K of the present invention, it becomes possible to discriminate, on a real time basis, data on a valid number plate to be combined with the ID plate 24, which is obtained from the ID plate reader 11 and data on an actual number plate combined with the ID plate 24, which is obtained from the number plate reader 15. Thus, since the two data on the number plate 26 are collated with each other by the comparator/collator 19, such excellent effects are achieved that illegal use of the ID plate 24 can be prevented and failure of the ID plate 24 can be judged on a real time basis.

The data on the number plate 26 can be added to the ID number of, for example, a 10-digit serial sequence as a portion of the ID number. Alternatively, it can also be so arranged that the data on the number plate 26, per se, formed by a transportation office code, a car model code, an application code, a 4-digit serial number, etc. is used as the ID number.

Fig. 3 shows the ID plate reader 11 and the number plate reader 15 referred to above. In Fig. 3, the ID plate 24 mounted on the motor vehicle 25 performs information interchange with the road antenna 12 of the ID plate reader 11 by radio, etc. and the number plate 26 mounted on the

motor vehicle 25 is shot by the camera 16 of the number plate reader 15.

Fig. 1 shows one example of an arrangement of the ID plate 24 employed in the system K. In response to a call from the road antenna 12, the ID plate 24 fetches the characteristic ID number of a serial sequence from an ID number storage 27 and fetches the data on the number plate 26 from a number plate data storage 28. An ID data synthesizer 29 synthesizes the above characteristic ID number and the above data on the number plate 26 into the data on the serial ID number such that a response signal is transmitted from a plate antenna 32 to the road antenna 12 through a modulation signal generator 30 and a modulator 31.

In this embodiment, at least a portion of the data on the ID number written on the ID plate 24 contains the data on the number plate 26 of the motor vehicle 25 to be provided with the ID plate 24, for example a motor vehicle under contract for automatic collection of toll of the toll road, a motor vehicle permitted to enter into a security zone, etc., thereby resulting in remarkably great security of the system K.

It is needless to say that if, especially, the number plate data storage 28 is formed into a ROM or a constant setting portion such as a setting pin, a setting switch, etc., reliability of data stored in the number plate data storage 28 is superior to that of a case in which the number plate data storage 28 is formed by a RAM.

Furthermore, if the number plate data storage 28 is formed by an independent ROM or constant setting portion, it becomes possible to flexibly set the data on the number plate 26 in accordance with its applications. Therefore, if the data on the number plate 26 is so set as to overlap the data on the ID number of a serial sequence, which is stored in the ID number storage 27 at the time of manufacture of the ID plate 24 at a plant, etc., thereby resulting in improvement of security of the system K as well as flexible setting of the data on the number plate 26.

Furthermore, from a standpoint of achievement of security of the data on the number plate 26, it is preferable that the number plate data storage 28 is formed such that once data has been stored in the number plate data storage 28, rewriting of the data in the number plate data storage 28 cannot be performed. Thus, it is desirable for the number plate data storage 28 that the ROM cannot be removed from its mounting portion after writing of data therein or the constant setting portion is fixedly secured to its mounting portion after setting of a constant.

As is clear from the foregoing description, in the system of the present invention, the characteristic ID number of the ID plate and the variable vehicle number of the number plate are stored so as to be transmitted by radio in response to a call from the road antenna. Therefore, by receiving the ID number and the vehicle number by the road antenna, illegal entry of the motor vehicle into the

specific areas can be prevented through check of the ID number and comparison between the vehicle number obtained from the ID plate and the actual vehicle number.

Furthermore, in the present invention, at least a portion of the data on the ID number written on the ID plate contains the data on the number plate of the motor vehicle to be provided with the ID plate, for example, a motor vehicle under contract for automatic collection of toll of the toll road, a motor vehicle permitted to enter into a security zone, etc. and the automatic vehicle identification system includes the comparator/collator for comparing and collating with each other, the data on the number plate obtained from the ID plate reader and the data on the number plate obtained from the number plate reader. Thus, in accordance with the present invention, it becomes possible to judge on a real time basis whether or not the ID plate is mounted on a valid motor vehicle, so that illegal use of the ID plate can be prevented, thereby resulting in great security of the system.

Meanwhile, information interchange between the ID plate and the ID plate reader may be performed through radio communication or optical communication and the ID plate may employ bar code so as to be optically read.

The ID plate 24 is the subject of divisional application No. 92 16601.6 .

## CLAIMS

1. An automatic vehicle identification system comprising an identification plate for performing radio or optical ~~radio~~ transmission of a characteristic identification number and a vehicle number, which is mounted on a motor vehicle; an identification plate reader for receiving signals outputted from the identification plate so as to read the identification number and the vehicle number; a number plate reader for optically reading a number plate of the motor vehicle; and a comparator/collator for comparing a signal of the identification plate reader with a signal of the number plate reader.

2. A system according to claim 1, wherein the identification plate comprises an identification number storage for storing a characteristic identification number of the identification plate; a number plate data storage for variably storing a vehicle number of a motor vehicle mounted with the identification plate; an identification data synthesizer for synthesizing a signal of the number plate data storage and a signal of the identification number storage into a synthetic signal having a predetermined form; and a modulation signal generator which transmits by radio or optically the synthetic signal of the identification data synthesizer from a transmitter in response to a call from a transmitter installed on a road.

3. An automatic vehicle identification system, substantially as described with reference to the accompanying drawings.