

The present invention relates to an automatic control system for the state of traffic, in particular road traffic. The expression automatic control includes, in a non-limiting manner, the following functions: control of duration, payment, presence, absence, etc. It relates to the control of traffic whether the vehicles are moving or stationary. In the first case an objective is to supervise observation of the traffic regulations, to assist in statistical recording, and to assist in the prevention of theft of vehicles. In the second case an objective may be to favour the use of public transport.

The various problems posed by the use of vehicles are known, in particular in large cities where the massive amount, even saturation, of traffic spoils life for everyone. In particular, the parking of vehicles is one of the principal causes of this. The rules in force are intended to organise parking and, in particular by limiting them to a predetermined duration (for example two hours), to encourage drivers to use public transport. At first, parking authorized for a fixed duration was controlled by the displaying of a disc, called a parking disc, by means of which each driver indicated the time at which he had parked his vehicle. The disc displayed the time limit before which the driver was obliged to recover his vehicle or to move it without incurring a fine. In a very short time local councils, which manage parking on their territory, replaced the use of these free discs by systems using parking spaces for which payment is made. Different systems have been installed which are based on the principle of prepayment for a parking duration at a parking authorization terminal and the delivery by this terminal of a parking ticket or, more generally, a temporary parking permit corresponding to the amount paid. These parking terminals only imperfectly fulfil the role assigned to them.

In practice at the end of the parking period there is nothing to stop the owner of the vehicle repeating his prepayment operation and causing the grant of an additional parking authorization for a further period. This is all the more easy for him since his vehicle already occupies a parking space which, in a way, he reserves for himself. In

principle the repetition of the request for parking longer than a defined duration is forbidden. However, the agents of the parking authority who are employed to supervise all the vehicles parked in their sectors must, in order to impose a penalty on their drivers, detect which of these vehicles are parked for an abnormally long time. This detection is difficult and it can only be performed rigorously if the said agents scrupulously record the registration numbers of the vehicles present in the areas which they control. They then have to compare these records from hour to hour to detect the changes in them. The complexity of this verification is such that it is not undertaken in practice. Some drivers make use of this fact in defiance of the regulations.

In addition, handicapped persons who drive specially adapted vehicles may have difficulty in reaching, using their wheelchairs, the parking terminal associated with the space which their vehicle occupies. The path to reach it may, for example, be blocked or impassable in their wheelchair. In some cases the absence of an easily visible terminal may annoy drivers when they seek to find one.

So far as moving vehicles are concerned, it is necessary to consider the problems presented by violations of the driving regulations (for the most part exceeding speed limits), the problems presented by wear of the roads and, lastly, the problems presented by theft of vehicles.

From patent application FR-A-2 594 985 a parking control system in accordance with the preamble of claim 1 is known which simplifies some of these operations.

In this system in accordance with the state of the art, each vehicle is equipped with a parking control device which receives a card including a chip having a prepayment memory zone. The device comprises means for storing a clock signal, which counts down the time in the prepayment memory zone of the card, and keys, corresponding to different parking tariffs, for selecting the frequency of the clock signal.

In this known system it is therefore necessary for the person using the vehicle to select the frequency of the clock signal himself, according to the parking tariff applicable.

The present invention aims in particular to overcome this disadvantage.

This objective is achieved, in accordance with the invention, by means of the system defined in claim 1.

The invention will be better understood on reading the following description with reference to the accompanying drawings. These are given only by way of non-limiting illustration of the invention. The Figures show:

- Figure 1: an example of employment of the system of the invention in a parking control application;
- Figure 2: a diagrammatic scheme showing the use of the card in the preceding application;
- Figure 3: an example of employment of the system when the vehicles are moving, and
- Figure 4: a typical flowchart for the exchange of data between the station and the vehicle.

Figure 1 shows an application of the automatic control system for the state of traffic in accordance with the invention. In this application a parking space 1 is occupied by a vehicle such as 2. Each vehicle 2 controls, for example in a radioelectric transmitter-receiver smart card reader-recorder 3, an associated smart card 4. A station such as 5, disposed inside the parking area comprises an emitter which, by means of an aerial 6, emits a signal which is received by a radio receiver contained in the reader 3 of the vehicle 2. Alternatively the exchange means may be optical or magnetic. The smart card 4 includes, in a simple parking application, prepayment account units, represented here symbolically by diodes, stored in a memory zone 7. The reader 3 is provided with, for example, two luminous indicator lamps 8 and 9,

respectively green and red in colour. In practice, the prepayment smart card 7 cancels its account units at the frequency of the supply of pulses of a clock signal emitted by the station 5. As long as the prepayment credit contained in the zone 7 is sufficient, the indicator lamp 8 remains lit. When the credit is used up the red indicator lamp 9 lights up and signals to an agent of the operating firm that the vehicle is now committing an offence as a result of default of payment.

In a more advanced version the smart card 7, at the time it is purchased from a distributor 10, may be programmed by using a programming terminal 11 equipped with a slot 12 for receiving the card and a programming keyboard 13. The registration details of the vehicle 2 can be programmed into it there, that is to say not only its registration number but also, for example, to simplify the work of the agents, the type of vehicle and also its colour. Other data relating to a subscription number, registration as handicapped, or a permit pass, may also be stored in it. They make possible the personalization of the card, for example with regard to the parking duration allowed or with regard to the tariff rates. In this improved version the smart card reader 3 is not only a reader associated with a radio receiver - it is a reader associated with a radio emitter-receiver. It is therefore possible for this emitter to emit to the station 5 data relating to the registration details of the vehicle 2 in such a manner that a car park employee may, on opening the door 14 of the said station 5, have access to a keyboard 15 for interrogating the authorization of parking of the vehicles present. A display screen 16 may also indicate, when a payment default is discovered, the registration details of the vehicle concerned. The work of detecting the vehicle 2 in the area supervised by the car park employee is then greatly facilitated by the knowledge of the type of vehicle, its colour and also its registration number. A penalty ticket issuer 17 may also be automatically coupled to the terminal 5 to facilitate the work of the said car park employee. This issuing device may also emit a signal increasing the hourly payment rates. Furthermore, at the time of parking the driver may program a number relating to the space which his vehicle occupies. This information also makes it possible to manage the spaces available in the park at a centralized level.

Figure 2 shows the operating diagram of an application of the invention of the type shown in Figure 1. In this application the desired aim substantially is to limit the duration of parking to a predetermined duration, even if the prepayment credit is sufficient to cover a longer duration. A radio receiver 18 associated with the reader 3 transmits to the card 4, for example through one of the metal contacts 19 of the said card, a clock signal originating from the terminal 5 and representative of the time elapsing. The card may, however, include its own emitter, its own receiver or its own emitter-receiver. It also transmits on another input 20 of the card a signal which identifies the parking terminal. The said signal is directed, by means shown symbolically by a switch 21, into a register 22. The clock pulse signal is directed, on the one hand during counting down to the prepayment zone 7 and, on the other hand, to a counter 23 contained in the card. When the zone 7 is empty (zero prepayment credit) or when the counter 23 is full (when a duration limit stored in the counter is exceeded) each of these supplies a signal indicating the said situation.

These signals are collected in an OR-gate 24 connected to a monostable device 25. The monostable device 25 has, in one example, a holding time for maintaining its state of about fifteen minutes. During this holding time, the monostable device 25 causes switching of the switch 21. Under these conditions the identity of the parking terminal 5 received by the receiver 18 is now directed to a second register 26 similar to the first. The registers 22 and 26 are connected to a comparator 27. Because the register 22 contains data representative of the identity of the terminal 5, and because the register 26 now contains the same data, the comparator 27 switches over and supplies an alarm signal 28 - lighting of the red indicator light 9 of the vehicle 2 for example. This alarm signal may also cause an entry to be written on to a special list of names of bad payers who may then be subjected to payment of increased rates. Conversely, there may also be a list of good payers: their rates will be reduced. At the end of the period during which the monostable device is switched over, the latter returns to its initial state and causes the return of the switch 21 and

the resetting to zero (RAZ) both of the counter 23 and of the register 26. When the duration of parking does not have to be limited, when it suffices to make the owners of the vehicles pay pro rata for the duration of their parking, the stations 5 are designed not to emit their identification. This absence of identification may be coupled to the signals for resetting the counter to zero in such a manner that the counter 23 is permanently kept at zero. Under these conditions the content of the register 26, which fills by default of a characteristic data item, is always different from the content of the register 22. The comparator 27 does not supply an alarm signal. However, in this case, because it is desired to supervise that payments are made correctly, the signal 29 available at the output of the zone 7 is used to produce the alarm. This signal 29 is in practice associated with the signal 28 in a second OR-gate 30 the output of which is in practice connected to the indicator lamp 9. In the improved alternative embodiment the signal available at the output of the gate 30 may be used to cause the emission, by the emitter-receiver 18, of the registration details 31 of the vehicle. The station 5 may then receive the data relating to the default in payment.

Figure 3 shows another application employing the same means for the system as those described above. For example, for speed limitation purposes it is possible to distribute along a road 32 a set of stations such as 33 each equipped with an identification means and a clock. The clocks 33 of all the stations are set to the same time. Moreover they are synchronised. Figure 4 shows a diagram of the manner in which the control system operates in this case. When a vehicle approaches a station the latter detects it in a first operation 34. This detection may be effected by any means and in particular by a radar system employing electromagnetic or acoustic radiation. This detection may also be achieved by the passage of the vehicle over a mechanical or magnetic pad. When a vehicle is detected the station 33 emits to the vehicle an instruction 35 for affecting the state of the emitter-receiver 18. The said emitter-receiver recognises the presence of a station by means of a routine 36 and immediately starts to emit its registration details by means of a

routine 37. The routines 36 and 37 may be easily programmed into the smart card 4 contained in the reader 3 of the vehicle by using the microprocessor 38 contained in the said card.

The absence of reception of the registration details of the vehicle 2 by the station 33 may be interpreted as a defect in the operation of the control system by the party in the vehicle and can cause the triggering of an alarm 48. The triggering of the alarm 48 may also be caused if the station 33 recognises that the registration details received are the registration details of a stolen vehicle of which it has knowledge by other means. This technique makes it possible, in short, to follow the progress of a stolen vehicle all along the route which its driver takes.

Otherwise than in these cases, the emitter-receiver 18 of the vehicle 2 receives from the station, in an operation 39, a clock signal representative of the moment at which it passes the station 33. This time at which it passes is stored in the card 4. When, subsequently, the vehicle passes in front of a station 40 located at a distance 41 from the station 33, the same operation is repeated. The card then contains in its memory the times of passage in front of the stations 33 and 40, on the one hand, and, as a result of comparison of the identities of the stations 33 and 40, the distance 41 on the other hand. It is therefore possible to deduce from these the speed of the vehicle over this distance 41. This speed which potentially can be written into the card may then be used by the traffic police to prove, indisputably, when the card is produced, that an authorized speed has been exceeded over the section 41. When the road 32 is a motorway for use of which a toll is paid, it is possible to use the information about the speed to adjust the payment to be made by the user in relation to the speed at which he has driven. It is known in practice that the degradation of roads is greater the faster vehicles are driven on them. It may therefore be useful, in a concern for sound management, to make use of the motorway more expensive for persons who drive vehicles at a fast speed than to those who drive more slowly. Alternatively the payment may be performed while moving without it being

necessary to stop at the entry and exit stations on the motorway. These stops are often the cause of accidents.

In a simpler application, where it is not desired to control stolen vehicles for example, it may suffice for the station to emit a clock signal and a signal for identifying the station. In short, only the operation 39 is performed. Nevertheless, this operation 39 is recorded in the card 4 in order for the authority which manages the said card to determine if the payment price needs to be increased or if a penalty for excess speed should be imposed. In a particularly useful application the terminals 33 and 40 may be located at the entrances to and exits from villages such as 42 distributed along a major road 32. Instead of an identification code, each station 33 or 40 may then emit a period representative of the minimum time taken to pass over the distance 41, taking into account any speed limit imposed between the terminals 33 and 40. The card 4 may then receive as data the time of day at which the vehicle passes in front of the station 33 and the minimum time taken to pass over the said distance. If this minimum duration is added to the time at which the vehicle passes, the time at which the vehicle passes in front of the terminal 40 should be later than this calculated time. It then suffices to compare the two passing times stored in the card 4 to determine if there has or has not been a violation.



CLAIMS

1. An automatic control system for the state of vehicular traffic, in particular road traffic, and in particular for control of parking, comprising:

- smart cards (4) associated with the vehicles (2),
- prepayment memory zones (7) in chips in the said cards
- and means (18, 19) for storing a clock signal progressively counting down the available time left in the prepayment memory zones of the cards, characterized in that it comprises:
 - emitting stations (5) at distributed traffic locations, and
 - means (6, 18) for exchanging data between the cards and the stations comprising, in each station, an emitter emitting the said clock signal progressively counting down the time and, in each vehicle, a receiver (18) for receiving the clock signal and transmitting it to the card.

2. A system according to claim 1, characterized in that the emitter of a station also emits a signal (22) representative of the said station.

3. A system according to either one of claims 1 and 2, characterized in that the cards comprise memory zones (31) for storing the respective registration numbers of the vehicles and in that the means for exchanging data also comprise, in each vehicle, an emitter for emitting the registration numbers of the vehicle and, in each station, a receiver for receiving the registration numbers of the vehicles.

4. A system according to any one of claims 1 to 3, characterized in that the cards comprise memory zones connected to a microprocessor (38) for processing the clock signal in response to a signal emitted by a station and representative of the said station.