

A DEVICE AND METHOD FOR MONITORING AND ALERTING ABNORMAL SITUATIONS AT A CAR PARK LANE CONTROL POINT

FIELD OF THE INVENTION

This invention relates to a monitoring and alert device for a car park lane control point, and to a method of monitoring for abnormal situations at a car park control point and issuing an alert.

BACKGROUND OF THE INVENTION

The discussion of the background art, any reference to a document and any reference to information that is known, which is contained in this specification, is provided only for the purpose of facilitating an understanding of the background art to the present invention, and is not an acknowledgement or admission that any of that material forms part of the common general knowledge as at the priority date of the application in relation to which this specification was filed.

To implement an automated car park control system, it is necessary to install equipment at entry and exit lane control points. Normally, the equipment at a car park lane control point includes at least a sensor for vehicle detection, a terminal station for vehicle identification (ID), access control and/or payment control, and a barrier mechanism for executing the access control. An example of such equipment is shown in Figure 2. A display panel may be used to show motorists the number of remaining parking lots available in the car park and/or the car park full information.

The need to monitor for abnormal situations, including abnormal operation of car park equipment, at a car park control point arises for various reasons. For example: a) power failure or any equipment failure may cause inconvenience to motorists, a traffic jam or loss of parking fee revenue; b) unauthorized manual opening of the barrier may result in a reduction of the parking fee revenue collected. Furthermore, providing a real time alert upon the occurrence of abnormal situations at a car park lane control point is important to reduce the problem recovery time (i.e. potential downtime) as well as to minimize the possible revenue loss.

Some existing automated parking control systems may have some provision for monitoring certain equipment errors, such that if an equipment failure is detected, an alert message may be displayed on the screen of the management computer. However, this kind of monitoring and alerting of existing systems has the following limitations:

- a) appropriate action cannot be taken if an alert message is received at the management computer when there is nobody at the computer;
- b) existing parking control systems can monitor only certain equipment problems and cannot monitor abnormal operation situations such as a vehicle being stationary, e.g. stuck, at the car park lane control point without equipment failure or with equipment failure that cannot be detected by the system; and
- c) whilst some existing parking control systems may be able to monitor and record an open barrier, by using a manual switch, they do not provide any alerting function.

OBJECT OF THE INVENTION

The object of the present invention is to provide a reliable monitoring and alert function for a car park lane control point.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention there is provided a monitoring and alerting device for a car park lane control point comprising

at least one equipment interface to receive monitoring information from equipment at the car park lane control point,

a microprocessor to receive data pertaining to the monitoring information from the equipment interface and to determine if an abnormal situation has occurred, at the car park lane control point, based on the data pertaining to the monitoring information,

data communications means to receive an alert signal from the microprocessor if the microprocessor determines that an abnormal situation has occurred and then to issue an alert message, and

an antenna coupled to the data communications means to transmit the alert message to one or more predefined mobile telephones via a mobile telephone network to thereby provide an alert that an abnormal situation has occurred at the car park lane control point.

Preferably, the microprocessor is arranged to determine the nature of the abnormal situation that has occurred such that the alert signal and the alert message indicate the nature of the abnormal condition.

Preferably, the device further comprises a memory to store data required for operation of the device.

Preferably, the data required for operation of the device includes one or more alert messages and the numbers of the one or more predefined mobile telephones.

Preferably, the device further comprises a power supply unit to provide power for the device in the event of a failure of a main power supply source.

Preferably, the equipment interface comprises at least one digital input circuit to receive equipment status signals from the equipment at the car park lane control point.

Preferably, the equipment status signals relate to the status of one or more of the following: barrier manual control switch status; barrier status; vehicle detector output; number of remaining parking lots available; and, car park full.

Preferably, the equipment interface comprises a serial communications interface circuit or a local area network interface circuit to receive data regarding the number of remaining parking lots available in the car park from equipment at the car park control point.

Preferably, the power supply unit comprises an uninterruptible power supply or a solar power system.

Preferably, the device comprises a wireless data communications circuit to transmit information to and receive information from a host computer for reporting, analysis and/or configuration purposes.

Preferably, the antenna is arranged to also transmit the alert message to a host computer.

Preferably, the device further comprises a clock to measure time periods, relating to the data pertaining to the monitoring information received from the equipment interface, before an abnormal situation is determined to have occurred.

Preferably, the clock is provided as a hardware real time clock and the clock is arranged to also provide the event time at which the abnormal situation occurred.

Preferably, the clock is provided as a software timer clock and the event time at which the abnormal situation occurred is the time at which the alert message was received by

the one or more predefined mobile telephones, or alternatively, the time at which the alert message was sent to the one or more predefined mobile telephones.

Preferably, the abnormal situation is one or more of the following: barrier arm does not close (i.e. barrier arm remains raised or retracted) for longer than a predefined time period; a vehicle is stationary at a car park entry control point for longer than a predefined time period when the car park is not full; a vehicle is stationary at a car park exit control point for longer than a predefined time period; the counter for the number of remaining parking lots available hangs; the barrier has been opened manually; and, failure of a main power supply source.

In accordance with another aspect of the present invention there is provided a method of monitoring for abnormal situations at a car park lane control point and issuing an alert comprising

receiving monitoring information from equipment at the car park lane control point, determining if an abnormal situation has occurred, at the car park lane control point, based on at least some of the monitoring information, issuing an alert message following the determination that an abnormal situation has occurred at the car park control point, and

transmitting the alert message to one or more predefined mobile telephones via a mobile telephone network to thereby provide an alert that an abnormal situation has occurred at the car park lane control point.

Preferably, determining if an abnormal situation has occurred, at the car park lane control point, based on at least some of the monitoring information further comprises determining the nature of the abnormal situation and issuing an alert message following the determination that an abnormal situation has occurred at the car park control point further comprises indicating the nature of the abnormal situation in the alert message.

Preferably, the method further comprises retrieving the numbers of the one or more predefined mobile telephones from a memory.

Preferably, the method further comprises providing a power supply to supply power in the event of a failure of the main power supply.

Preferably, the method further comprises receiving equipment status signals from the equipment at the car park lane control point.

Preferably, in the method herein before described, the equipment status signals relate to the status of one or more of the following: barrier manual control switch status; barrier status; vehicle detector output; number of remaining parking lots available; and, car park full.

Preferably, the method further comprises receiving data regarding the number of remaining parking lots available in the car park from equipment at the car park control point.

Preferably, the method further comprises transmitting information to and receiving information from a host computer for reporting and/or configuration purposes.

Preferably, the method further comprises transmitting the alert message to a host computer.

Preferably, the method further comprises measuring time periods, relating to at least some of the monitoring information received from the equipment interface, before determining that an abnormal situation has occurred.

The method may further comprise providing the event time, at which the abnormal situation occurred, using a hardware real time clock.

Alternatively, the method may further comprise providing the event time, at which the abnormal situation occurred, as the time at which the alert message was received by the one or more predefined mobile telephones, or alternatively, as the time at which the alert message was sent to the one or more predefined mobile telephones.

Preferably, in the method herein before described, the abnormal situation is one or more of the following: barrier arm does not close (i.e. barrier arm remains raised or retracted) for longer than a predefined time period; a vehicle is stationary at a car park entry control point for longer than a predefined time period when the car park is not full; a vehicle is stationary at a car park exit control point for longer than a predefined time period; the counter for the number of remaining parking lots available hangs; the barrier has been opened manually; and, failure of a main power supply source.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of an embodiment of the monitoring and alerting device in accordance with one aspect of the present invention;

Figure 2 is an illustration of an example of the equipment setup that may be provided at a typical car park lane control point; and

Figure 3 is an illustration of an embodiment of the application of the device in accordance with the present invention to a car park entry lane control point and a car park exit lane control point.

DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

In Figure 1 there is shown a schematic diagram of a monitoring and alerting device 1, for a car park lane control point, comprising at least one equipment interface 2, a microprocessor 3, a data communications circuit 4 and an antenna 5.

The equipment interface 2 receives monitoring information from the equipment at the car park lane control point. For example, the monitoring information may relate to the status of one or more of the following: barrier manual control switch status; barrier status; vehicle detector output; number of remaining parking lots available; and, car park full.

The microprocessor 3 receives data pertaining to the monitoring information from the equipment interface 2. The microprocessor 3 performs the required algorithms to determine if an abnormal situation has occurred, at the car park lane control point, based on the data it receives from the equipment interface 2. The data pertaining to the monitoring information that the microprocessor 3 receives from the equipment interface 2 may be all of the monitoring information that the equipment interface 2 receives from the equipment at the car park control point, or alternatively, only the actual data that the microprocessor 3 requires to determine if an abnormal situation has occurred at the car park lane control point. For example, abnormal situations may include one or more of the following: barrier arm does not close (i.e. barrier arm remains raised or retracted) for longer than a predefined time period; a vehicle is stationary at a car park entry control point for longer than a predefined time period when the car park is not full (signifying that the vehicle may be immobile, e.g. stalled, stuck, etc); a vehicle is stationary at a car park exit control point for longer than a predefined time period (signifying that the vehicle may be immobile, e.g. stalled, stuck, with unpaid parking fee, etc); the counter for the number of remaining parking lots available hangs (i.e. the counter for the number of remaining parking lots available remains unchanged for a predefined time period even though there are vehicle movements into and/or out of the car park during that time period); the barrier has been opened manually, e.g. by a manual control switch; and, failure of a main power supply source.

If the microprocessor 3 determines that an abnormal situation has occurred at the car park lane control point, the microprocessor 3 issues an alert signal which is received by the data communications circuit 4. The data communications circuit 4 then issues an alert message.

The data communications circuit 4 is coupled to the antenna 5. The antenna 5 receives the alert message from the communications circuit 4 and transmits the alert message to predefined mobile telephones (also referred to as cellular telephones) via a mobile telephone (or cellular telephone) network to thereby provide an alert that an abnormal situation has occurred at the car park lane control point.

In addition to being able to determine if an abnormal situation has occurred at the car park lane control point based on the data it receives from the equipment interface 2, it is preferable that the microprocessor 3 is also able to determine the nature of the abnormal situation that has occurred based on the data it receives from the equipment interface 2. The alert signal that is issued by the microprocessor 3 then also indicates the nature of the abnormal situation as previously described herein, e.g. barrier arm does not close (i.e. barrier arm remains raised or retracted) for longer than a predefined time period, a vehicle is stationary at a car park entry control point when the car park is not full, etc. The alert message that is issued by the data communications circuit 4 and transmitted by the antenna 5 may then also indicate the nature of the abnormal situation that has occurred at the car park lane control point. In this way, when the alert message is received by the predefined mobile telephones, the alert provided indicates that an abnormal situation has occurred at the car park lane control point and also the nature of the abnormal situation.

The device 1 further comprises a memory 6, which is linked with the microprocessor 3. The memory 6 is used to store the device parameters, the alert messages that are issued by the data communications circuit 4 and transmitted by the antenna 5, the numbers of the predefined mobile telephones and the input and processed data received and processed by the microprocessor 3.

The device 1 further comprises a power supply unit 7 to provide power for the functioning of the components of the device 1 in the event of a failure of a main power supply source. For example, the power supply unit 7 may comprise an uninterruptible power supply, or alternatively, a solar power system, so that the device 1 can still function after a main power supply failure.

The equipment interface 2 includes at least one digital input circuit used to receive equipment status signals from the equipment at the car park lane control point. The equipment status signals, for example, may include barrier manual control switch status, barrier status, vehicle detector output and car park full.

The equipment interface 2 may also include a serial interface or a LAN (local area network) interface to receive the number of remaining parking lots available in the car park.

The data communications circuit 4 that is coupled to an antenna 5 may be a wireless communications circuit that transmits and receives data via a mobile telephone network.

The microprocessor 3 uses algorithms to determine if an abnormal situation has occurred based on the data pertaining to the monitoring information it receives from the equipment interface 2. Once the occurrence of an abnormal situation is determined, or detected, the microprocessor 2 will signal the data communications circuit 4 to issue the corresponding alert message (or alert messages in the case that more than one abnormal situation has been determined to have occurred). The alert message(s) is received by the antenna 5 which then transmits the alert message(s) via the mobile telephone network to the predefined mobile telephones. In this way, the appropriate person or persons are informed, via their mobile telephones, of the existence of the abnormal situation(s). This provides a targeted alert message to such persons. They can then initiate the appropriate action, such as servicing and/or supervisory action. The alert message(s) may also be sent to and received by a host computer for recording, analysis and reporting purposes.

The device 1 further comprises a clock 8. The clock 8 may be used to measure time periods, relating to the data pertaining to the monitoring information received from the equipment interface 2, before an abnormal situation is determined to have occurred, e.g. to measure the time period for which a barrier arm does not close (i.e. barrier arm remains raised or retracted), or the time period for which a vehicle is stationary at a car park entry or exit control point, or the time period for which the counter for the number of remaining parking lots available hangs even though there are vehicle movements into and/or out of the car park during that time period. In such circumstances, once a predefined time, or respective predefined time, has been reached, the microprocessor 3 determines that an abnormal situation has occurred.

By way of example, the clock 8 may be provided as a hardware real time clock or as a software timer clock.

In the case that the clock 8 is provided as a hardware real time clock, the (hardware real time) clock 8 may also be used to provide a timestamp of the event time at which the abnormal situation, or abnormal event, occurred. In the case that the clock 8 is provided as a software timer clock, the event time at which the abnormal situation, or abnormal event, occurred may be the time at which the alert message was received by the predefined mobile telephones, or alternatively, the time at which the alert message was sent to the predefined mobile telephones. The timestamp for any abnormal situation,

along with information about the nature of the abnormal situation, may be sent to and received by the host computer for recording, analysis and reporting purposes.

Figure 3 illustrates an embodiment of the application of the device 1 at car park lane control points, namely, a car park entry lane control point and a car park exist lane control point.

The car park equipment is normally provided at car parks where motorists must pay to park their vehicles. This car park equipment, however, does not form part of the present invention. The car park equipment typically provided at entry and exit lane control points includes vehicle detectors, entry and exit terminal stations, and barriers, including the barrier arms. The vehicle detectors are normally some kind of inductive loop coils and related detectors and are used to detect the presence of a vehicle. The entry terminal station usually has a ticket dispenser, a card dispenser or a card/transponder reader. A ticket (or a card or a transponder) is used to provide the vehicle ID. The exit terminal station usually has a corresponding ticket reader or a card/transponder reader that is used for reading the vehicle ID. The exit terminal station identifies the vehicle access right based on the vehicle's ID and, on the payment status if applicable, then determines whether the vehicle should be allowed to pass through. When it is determined that the vehicle should be allowed to pass through, the corresponding control command signal is sent to the barrier. The barrier is used to execute the access control command signal received from the exit terminal station. When an open command signal is received, the barrier will open (i.e. the barrier arm lift up or retract). Until the open command signal is received, the barrier will remain closed (i.e. the barrier arm remains in the lowered horizontal position) to block the drive way at the car park exit lane.

As shown in Figure 3, two devices 1 (identified as Device No. 1 and Device No. 2 in Figure 3) are installed at the respective car park entry and exit lane control points. Conveniently, the devices 1 are located at the entry and exit terminal stations. The devices 1 are interfaced with the corresponding car park equipment at the car park entry and exit lane control points so that they are able to receive the necessary monitoring information from the car park equipment. In the case of installation of the device 1 at an existing car park (i.e. a retro-fit of the device 1), it may be necessary to add some accessories to the car park equipment in order for the equipment interface 2 to receive monitoring information for monitoring purposes. For example, a barrier arm sensor may need to be installed if the existing barrier does not have the output representing the barrier arm status. The basic data should be first stored in the memory 6 of each device 1. The basic data may include the device ID, the alert messages, the numbers of the predefined mobile telephones, etc. The basic data can be preloaded in each device 1. The basic data can also be updated once the device 1 receives the corresponding commands and data from a host computer.

The nature of the abnormal situations that can be monitored in any particular installation of the device 1 depends upon the information that is available to the device 1 from the equipment at the car park lane control point. The typical types of such abnormal situations have been previously described herein.

Modifications and variations such as would be apparent to a skilled addressee are deemed to be within the scope of the present invention.

Claims

The claims defining the invention are as follows:

1. A monitoring and alerting device for a car park lane control point comprising

at least one equipment interface to receive monitoring information from equipment at the car park lane control point,

a microprocessor to receive data pertaining to the monitoring information from the equipment interface and to determine if an abnormal situation has occurred, at the car park lane control point, based on the data pertaining to the monitoring information,

data communications means to receive an alert signal from the microprocessor if the microprocessor determines that an abnormal situation has occurred and then to issue an alert message, and

an antenna coupled to the data communications means to transmit the alert message to one or more predefined mobile telephones via a mobile telephone network to thereby provide an alert that an abnormal situation has occurred at the car park lane control point.
2. A device according to claim 1, wherein the microprocessor is arranged to determine the nature of the abnormal situation that has occurred such that the alert signal and the alert message indicate the nature of the abnormal condition.
3. A device according to claim 1 or 2, further comprising a memory to store data required for operation of the device.
4. A device according to claim 3, wherein the data required for operation of the device includes one or more alert messages and the numbers of the one or more predefined mobile telephones.
5. A device according to any one of the preceding claims, further comprising a power supply unit to provide power for the device in the event of a failure of a main power supply source.
6. A device according to any one of the preceding claims, wherein the equipment interface comprises at least one digital input circuit to receive equipment status signals from the equipment at the car park lane control point.

7. A device according to claim 6, wherein the equipment status signals relate to the status of one or more of the following: barrier manual control switch status; barrier status; vehicle detector output; number of remaining parking lots available; and, car park full.
8. A device according to any one of the preceding claims, wherein the equipment interface comprises a serial communications interface circuit or a local area network interface circuit to receive data regarding the number of remaining parking lots available in the car park from equipment at the car park control point.
9. A device according to any one of claims 5 to 8, wherein the power supply unit comprises an uninterruptible power supply or a solar power system.
10. A device according to any one of the preceding claims, further comprising a wireless data communications circuit to transmit information to and receive information from a host computer for reporting, analysis and/or configuration purposes.
11. A device according to any one of the preceding claims, wherein the antenna is arranged to also transmit the alert message to a host computer.
12. A device according to any one of the preceding claims, further comprising a clock to measure time periods relating to the data pertaining to the monitoring information received from the equipment interface before an abnormal situation is determined to have occurred.
13. A device according to claim 12, wherein the clock is provided as a hardware real time clock and the clock is arranged to also provide the event time at which the abnormal situation occurred.
14. A device according to claim 12, wherein the clock is provided as a software timer clock and the event time at which the abnormal situation occurred is the time at which the alert message was received by the one or more predefined mobile telephones, or alternatively, the time at which the alert message was sent to the one or more predefined mobile telephones.
15. A device according to any one of the preceding claims, wherein the abnormal situation is one or more of the following: barrier arm does not close (i.e. barrier arm remains raised or retracted) for longer than a predefined time period; a vehicle is stationary at a car park entry control point for longer than a predefined time period when the car park is not full; a vehicle is stationary at a car park exit control point for longer than a predefined time period; the counter for the number of remaining parking lots available hangs; the barrier has been opened manually; and, failure of a main power supply source.

16. A method of monitoring for abnormal situations at a car park lane control point and issuing an alert comprising
- receiving monitoring information from equipment at the car park lane control point,
- determining if an abnormal situation has occurred, at the car park lane control point, based on at least some of the monitoring information,
- issuing an alert message following the determination that an abnormal situation has occurred at the car park control point, and
- transmitting the alert message to one or more predefined mobile telephones via a mobile telephone network to thereby provide an alert that an abnormal situation has occurred at the car park lane control point.
17. A method according to claim 16, wherein determining if an abnormal situation has occurred, at the car park lane control point, based on at least some of the monitoring information further comprises determining the nature of the abnormal situation and issuing an alert message following the determination that an abnormal situation has occurred at the car park control point further comprises indicating the nature of the abnormal situation in the alert message.
18. A method according to claim 16 or 17, further comprising retrieving the numbers of the one or more predefined mobile telephones from a memory.
19. A method according to any one of claims 16 to 18, further comprising providing a power supply to supply power in the event of a failure of the main power supply.
20. A method according to any one of claims 16 to 19, further comprising receiving equipment status signals from the equipment at the car park lane control point.
21. A method according to any one of claims 16 to 20, wherein the equipment status signals relate to the status of one or more of the following: barrier manual control switch status; barrier status; vehicle detector output; number of remaining parking lots available; and, car park full.
22. A method according to any one of claims 16 to 21, further comprising receiving data regarding the number of remaining parking lots available in the car park from equipment at the car park control point.
23. A method according to any one of claims 16 to 22, further comprising transmitting information to and receiving information from a host computer for reporting and/or configuration purposes.

24. A method according to any one of claims 16 to 23, further comprising transmitting the alert message to a host computer.
25. A method according to any one of claims 16 to 24, further comprising measuring time periods, relating to at least some of the monitoring information received from the equipment interface, before determining that an abnormal situation has occurred.
26. A method according to any one of claims 16 to 25, further comprising providing the event time, at which the abnormal situation occurred, using a hardware real time clock.
27. A method according to any one of claims 16 to 25, further comprising providing the event time, at which the abnormal situation occurred, as the time at which the alert message was received by the one or more predefined mobile telephones, or alternatively, as the time at which the alert message was sent to the one or more predefined mobile telephones.
28. A method according to any one of claims 13 to 21, wherein the abnormal situation is one or more of the following: barrier arm does not close (i.e. barrier arm remains raised or retracted) for longer than a predefined time period; a vehicle is stationary at a car park entry control point for longer than a predefined time period when the car park is not full; a vehicle is stationary at a car park exit control point for longer than a predefined time period; the counter for the number of remaining parking lots available hangs; the barrier has been opened manually; and, failure of a main power supply source.