Figure 2 is a block diagram of one preferred embodiment including a vehicle, a radio frequency tag attached to a vehicle, a base station, an antenna, and a lot entrance.

Figure 3A is a flow chart showing the steps of an algorithm that handles the vehicle tracking, ownership, and identification.

Figure 3B is a flow chart showing the steps of an algorithm that handles determining if a vehicle is stolen from a closed dealership and gathering marketing information about a number of vehicle test drives.

Figure 3C is a flow chart showing the process steps determining if the vehicle needs service and whether the vehicle is in for service.

Figure 3D is a flow chart showing the algorithm determining if vehicle service is complete and the bill for this vehicle has been paid.

Figure 4 is a flow chart showing the steps of an algorithm that handles the determination that a dealer owned vehicle has been out of a lot for more than a predetermined lot time. "Timeout Violation".

Figure 5 is a flow chart showing the steps of an algorithm that performs the constructing, sending, and logging of pages.

Figure 6 is block diagrams of the preferred data structure of the records and tables used in the applications: Vehicle Identification Record (Figure 6A), Customer Marketing Tag Record (Figure 6B), Logged Pager Record (Figure 6C), Assign Pager Record (Figure 6D), Lot Hours Closed Record (Figure 6E), Vehicle Out of Lot Record (Figure 6F), and Vehicle Marketing Summary Record (Figure 6F), and Vehicle Marketing Summary Record (Figure 6G).

Figure 7A is a block diagram showing typical "Stolen Vehicle" pager display.

Figure 7B is a block diagram showing typical "Timeout Violation" pager display.

Figure 8 is slow chart showing the steps of an algorithm that builds an marketing report based on customers with tagged vehicles re-entering a lot potentially shopping for an additional vehicle.

Figure 9 is flow chart showing the steps of an algorithm that builds a marketing report based on dealer owned tagged vehicles leaving and entering a lot.

Figure 10A is a block diagram of the preferred embodiment of the Customer Prospect Report.

Figure 10B is a block diagram of the preferred embodiment of the Vehicle Test Drive Report.

inventory control when each lot is part of an enterprise network of lots.

Figure 3 is a flow chart showing the steps of a preferred vehicle monitoring algorithm (300). See Figure 3A. The algorithm waits (305) for an interrupt from either a main base station (309) or an interrupt (307) coming from a remote computer (140) attached to one or more remote base stations (120). The interrupt is generated when the base station (120) detects that a vehicle is passing through an area access (110). As stated above, this occurs when the base station (120) detects a return signal (255) from a tag (210) on the vehicle (105) passing through the area access (110).

In step (310) the algorithm (300) reads vehicle ID (602) information and determines the lot, lot access and date/time. See Figure 6A. As stated above, the vehicle information (the vehicle ID identification) is determined by the base station (120) from the return signal (235). Some status information (lot/entrance and time information) is provided by the base station processor (122), remote computer (140), or central computer (130).

The next step is to read (312) additional status information including the Vehicle Identification File (314) in order to obtain complete information about the vehicle. In step (313) the validity of the ID (602) is determined. A tag is considered valid if a corresponding Vehicle Identification Record (601) exists for the ID (602). In one preferred embodiment these Vehicle Identification Records are indexed on ID field (602) for fast file access. In the future when many dealers use vehicle IDs it will be increasingly important to identify vehicles that were not owned or sold by the dealer (step 313). Past service records for vehicles can be very important in diagnosing a current vehicle problem. When a vehicle is identified as not in this computer system (313), a request (315) can be sent to a network of other dealer systems to fetch the appropriate service records. This technique is well known by those specialized in the art of computer networking. The algorithm then moves to Figure 3C where the system tests to determine if the vehicle has come on the lot for servicing (342). If service is preformed a check is made when the vehicle leaves to assure that all service was completed (347) and the bill paid (352). See Figure 30.

In one embodiment, the Vehicle Identification Record (601), particularly an Owner field (615), is checked in step (317) to determine if the vehicle is owned by the dealership "Dealership" or has been purchased by a customer (Customer Name, e.g. Bill Anderson). If the Owner field (615) is a customer then the algorithm moves to Figure 3C as above, where a test is made to determine if the vehicle is in for service. If the Owner field (615) is equal to "Dealership" then the hours the particular lot, main (101) or remote (102), is closed are determined in step (355) of Figure 3B from a Lot Hours Closed File (358). Step (360) provides the capability to change the information in the Lot Hours Closed File (358). In a preferred

embodiment, the Lot Hours Closed Records (670) is kept sequenced by lot, date and time. If the lot selected is not scheduled to be open at this time (675) in step (365) then an indicator is set to "Stolen Vehicle" and a message is sent to the Dealership General Manager to initiate appropriate action. The algorithm then goes to Figure 5 (500) to initiate a page. If the lot is selected to be open at this time (675) in step (365) the Vehicle Out of Lot Record (680) is written (385) to the Vehicle Out of Lot File (390) is kept sequenced by Vehicle ID (681), Date (685), Time (687) and In/Out (689) fields. In step (392) the Vehicle Out of Lot File (390) is read for the Particular Vehicle ID (680) both records are erased. The Vehicle Marketing Summary File (395), which contains marketing information about the number of times the vehicle has been taken off the lot (695) and the total time out of lot (697) is then updated with the vehicle total time driven (697) and the total number of times the vehicle has been driven (695). The algorithm then returns to the wait for another interrupt step (305).

Figure 3C is a flow chart (301) entered because the vehicle ID identified was not valid (313) or the vehicle ID identifies not owned by the dealership (317) in Figure 3A (300). After a predetermined time delay (336) which allows a customer to have a service ticket written and recorded in the computer the algorithm starts. In a preferred embodiment for automobiles the Dealer Service File (338) is read (337) for the particular vehicle ID (602) from the Dealer Management System (DMS). The art of building a Dealer Management System (DMS) with records of this type is well known in the industry, Information provided in the Dealer Service records will also be referred to as status information.

For future marketing applications the Customer Marketing Tag Record (630) is written (340) in the Customer Marketing Tag File (314). If the vehicle is not in for service (342), the algorithm returns to wait for another interrupt (350). If the vehicle is in for service a check is made to determine if there have been two readings of the tag (344) and therefore the vehicle is leaving the lot (service completed). In block (345), the Dealer Service File (346) is rechecked to assure that all the service tasks have been completed (347). If not complete (351), the algorithm sends a message to the appropriate managers terminal (352). In one preferred embodiment the algorithm jumps to the pager algorithm (500) to inform the manager (150) by pager (155). If the service is complete, the Accounts Receivable File (349) in the DMS System is read (348) to determine if the bill has been paid to the dealership. If the bill is paid the algorithm moves back to wait for another interrupt (350). When not yet paid (353), the appropriate management terminal (354) receives the message "Bill Not Paid". In a preferred embodiment, the algorithm jumps to the pager algorithm (500) to inform the manager (150) by pager (155).

CLAIMS

1. A system for monitoring vehicles passing through an area access to a vehicle storage area comprising: one or more vehicle storage areas each with one or more area accesses, each area access having a base station antenna electrically connected to a base station;

one or more vehicles with a radio frequency tag attached, the radio frequency tag having a tag antenna, a tag radio frequency section, and a tag memory, the tag memory having vehicle ID information about the vehicle to which the radio frequency tag is attached;

one or more of the vehicles being a passing vehicle passing through one of the area accesses while a radio frequency signal is communicating between the base station and the radio frequency tag through the base station antenna and the radio frequency tag antenna respectively, and the tag radio frequency section placing the vehicle ID information on a return radio frequency signal sent to the base station;

one or more computers having status information in a computer memory, the status information including ownership information about the passing vehicle that is associated with the vehicle ID information, the status information further including other information; and

an algorithm, executed by the computer, that uses the ownership information about the passing vehicle and the other status information to perform a specified action.

2. A system, as in claim 1, where the ownership information indicates that the passing vehicle is not owned by a dealership and the other information indicates an area identification of the vehicle storage area and one or more area times, the algorithm determining that the passing vehicle is not authorized to leave the storage area at one or more of the area times.

3. A system, as in claim 1, where the ownership information indicates that the passing vehicle is not owned by a dealership, the other information is maintenance information that indicates that the passing vehicle is unauthorised because the dealership

has not completed the predetermined servicing for the passing vehicle and the specified action is a message sent to a manager.

4. A system, as in claim 3, where the message is an alphanumeric page sent to the manager, the page providing information identifying the passing vehicle.

5. A system, as in claim 1, where the ownership information indicates that the passing vehicle is not owned by a dealership, the other information includes billing information, the algorithm determines that the vehicle is unauthorized because a service bill has not been paid and the specified action is a message sent to a computer terminal.

6. A system as in claim 5, where the specified action is a page sent to a manager.

7. A system, as in claim 1, where the ownership information indicates the passing vehicle is owned by a dealership and the other information includes storage area information that indicates that the storage area is closed.

8. A system, as in claim 7, where the algorithm determines the passing vehicle is being stolen and the specified action is a message sent to a computer terminal.

9. A system, as in claim 7, where the algorithm determines the passing vehicle is being stolen and the specified action is a page sent to a manager.

10. A system, as in claim 1, where the ownership information indicates the vehicle is owned by a dealership and the other information indicates that dealership is open.

11. A system, as in claim 10, where the other information further indicates an amount of time the passing vehicle is out of the storage area and the amount of time is recorded.

12. A system, as in claim 11, where the computer algorithm periodically checks the amount of time to see if the time the passing vehicle has been out of the storage area exceeds a storage area time parameter.

13. A system, as in claim 12, where the specified action is a message sent to a computer terminal when the amount of time exceeds the storage area time parameter.

14. A system, as in claim 12, where the specified action is a page sent to a manager when the time the vehicle has been out exceeds the storage area time parameter.

15. A system, as in claim 11, where the computer algorithm tracks the amount of time the passing vehicle has been out of the vehicle lot.

16. A system, as in claim 10, where the computer algorithm keeps track of the number of times one or more of the passing vehicles has been taken for a test drive.

17. A system, as in claim 10, where the algorithm generates a marketing report indicating customer preference.

18. A system, as in claim 17, where the marketing report is based on the amount of time the passing vehicles was out of the storage area.

19. A system, as in claim 17, where the marketing report is based on the number of times a vehicle passed through one of the area accesses.

20. A system, as in claim 1, where the ownership information indicates that the passing vehicle is not owned by a dealership, the other information includes a service history for the vehicle, the algorithm determines from the other information that the passing vehicle needs service and the specified action is a message sent to a computer terminal indicating that the passing vehicle needs service.

21. A system, as in claim 1, where the ownership information indicates that the passing vehicle is not owned by a dealership, the other information includes service information, the algorithm determines from the other information that the passing vehicle needs service and the specified action is a page sent to a manager indicating that the passing vehicle needs service.

22. A system as in claim 1, where the status information is sent from a remote computer in a remote location.

23. A system, as in claim 22, where the status information is a service record of the passing vehicle.

24. A system, as in claim 1, where the ownership information indicates that the passing vehicle is not owned by a dealership, the other information is a service record of the passing vehicle and the specified action is to send a communication from the base station that writes the service record on the tag memory.

25. A system, as in claim 1, where the ownership information indicates that the passing vehicle is not owned by a dealership and tag memory also has a service record about the passing vehicle in the tag memory, the tag radio frequency section also places the service record on the return radio frequency signal.

26. A system, as in claim 25, where the algorithm uses the vehicle ID information and the service record to take the specified action of indicating that the vehicle needs service.

27. A system for monitoring cars passing through an entrance to a car dealership car lot comprising:

one or more car lots each with one or more entrances, each entrance having a base station antenna electrically connected to a base station;

one or more cars with a radio frequency tag attached, the radio frequency tag having a tag antenna, a tag radio frequency section, and a tag memory, the tag memory having car ID information, including a VIN (vehicle identification number), about the car to which the radio frequency tag is attached;

one or more of the cars being a passing car that passes through the entrance while a radio frequency signal communicates between the base station and the radio frequency tag through the associated base station antenna and the radio frequency tag antenna respectively, the tag radio frequency section placing the vehicle ID information on a return radio frequency signal sent to the base station when the passing car passes through the entrance;

one or more computers having status information, the status information including car ownership information about the passing car that is associated with the VIN, the status information further including other car information; and

an algorithm, executed by the computer, that uses the car ownership information of the passing car and the other car information to take an action.

28. A system, as in claim 27, where one of the computers is a central computer and the algorithm determines from the car ownership information that a car is not owned by the dealership.

29. A system, as in claim 28, where the computer algorithm records vehicle, customer lot, and a time the passing vehicle enters and leaves the car lot.

30. A system, as in claim 29, where the VIN is used to generate a marketing report identifying a potential car buyer.

31. A system for monitoring vehicles passing through an area access to a vehicle storage area comprising:

one or more vehicle storage areas means for storing vehicles each with one or more area accesses means, each area access means having a base station antenna means electrically connected to a base station means;

one or more vehicles means with an radio frequency tag means attached, the radio frequency tag means having a tag antenna, a tag radio frequency section, and a tag memory, the tag memory having vehicle information about the vehicle means to which the radio frequency tag is attached;

one or more of the vehicle(s) means being a passing vehicle that passes through the area access while a radio frequency signal communication between the base station means and the radio frequency tag means through the associated base station antenna means and the radio frequency tag antenna means respectively, the tag radio frequency section placing the vehicle information on a return radio frequency signal sent to the base station when the passing vehicle means passes through the access area;

one or more computer means having status information, the status information including ownership information about the passing vehicle that is associated with the vehicle ID information, the status information further including other information; and

an algorithm means, executed by the computer means, that uses the ownership information of the passing vehicle means and the other information to take an action.

32. A method for monitoring vehicles passing through an area access to a vehicle storage area comprising the steps of:



storing one or more vehicle storage areas each vehicle storage area having one or more area accesses, each area access having a base station antenna electrically connected to a base station;

attaching a radio frequency signal to one or more vehicles, the radio frequency tag having a tag antenna, a tag radio frequency section, and a tag memory, the tag memory having vehicle ID information about the vehicle to which the radio frequency tag is attached;

passing one or more passing vehicles through the area access while communicating a radio frequency signal between the base station and the radio frequency tag through the associated base station antenna and the radio frequency tag antenna respectively, the tag radio frequency section placing the vehicle ID information on a return radio frequency signal sent to the base station when the passing vehicle passes through the access area;

storing status information on one or more computers, the status information including ownership information about the passing vehicle that is associated with the vehicle ID information, the status information further including other information; and

executing an algorithm by the computer, the algorithm using the vehicle ID information of the passing vehicle, the ownership information, and the other information to take an action.

* C L M S *

SYSTEM AND METHOD FOR TRACKING VEHICLES IN VEHICLE LOTS

ABSTRACT

A radio frequency (RF) tagging system (100) is used to monitor vehicles (105) passing through an area access to one or more vehicle storage area(s) (101, 102). One or more of the vehicles (105) stored in the storage area is equipped with a RF tag (210) which has vehicle ID information about the vehicle stored in a tag memory (215) contained on the tag (210). The tag (210) communicates with a base station (120) when passing through the area accesses, (entering or leaving). A central (130) and preferably one or more remote computers (140) accesses status information that might include vehicle identification, customer, lot identification, time of day, and vehicle and lot status. The information is used in security functions including a paging system or marketing functions including determining how long or how many times different makes an model of vehicle are chosen by customers for test drives.

Fig. 1.