US 20060197836A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2006/0197836 A1

Orias (43) Pub. Date: Sep. 7, 2006

(54) **AIRPORT SECURITY SYSTEM**

(75) Inventor: **Geoffrey Orias**, Laguna Beach, CA (US)

Correspondence Address:
OSTRAGER CHONG FLAHERTY & BROITMAN PC
250 PARK AVENUE, SUITE 825
NEW YORK, NY 10177 (US)

(73) Assignee: **THE BOEING COMPANY**, Chicago, IL (US)

(21) Appl. No.: **10/906,757**

(22) Filed: **Mar. 4, 2005**

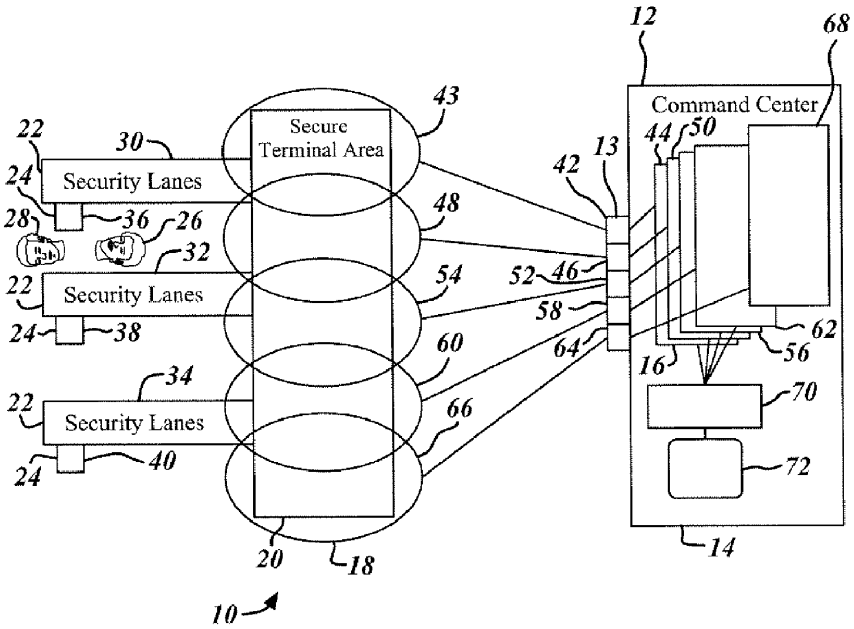
Publication Classification

(51) **Int. Cl.**
H04N 7/18 (2006.01)
H04N 9/47 (2006.01)
G06K 9/00 (2006.01)

(52) **U.S. Cl.** **348/143**; 382/181

(57) **ABSTRACT**

An airport security system includes a scanner scanning and time stamping an article of identification of an individual passing into a secure terminal area. The system further includes security cameras generating respective video signals of overlapping zones of coverage of the secure terminal area. The video signals are recorded and received in a controller generating a seamless video signal therefrom. Reversing of the seamless video signal allows visual tracking of a security breach in the secure terminal area from the time of breach identification scan and time stamp. Faster than real time forwarding of the seamless video signal allows tracking of the security breach from the time stamp to the breacher's present location within the secure terminal area.



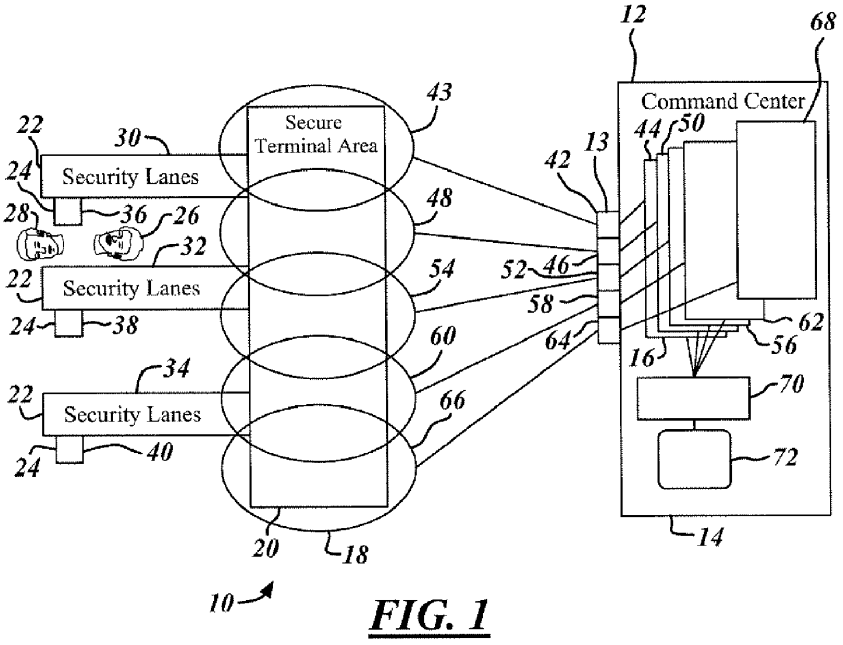

Secure Terminal Area
Security Lanes
Security Lanes
Security Lanes
Command Center
12
68
43
22
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FIG. 1

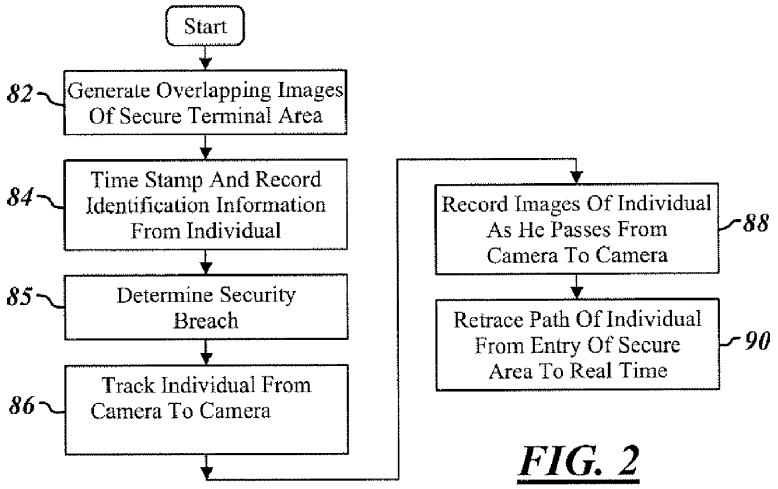
Start
Generate Overlapping Images Of Secure Terminal Area
82
Time Stamp And Record Identification Information From Individual
84
Determine Security Breach
85
Track Individual From Camera To Camera
86
Record Images Of Individual As He Passes From Camera To Camera
88
Retrace Path Of Individual From Entry Of Secure Area To Real Time
90

FIG. 2

AIRPORT SECURITY SYSTEM

GOVERNMENT CONTRACT

[0001] This invention was made with Government support under contract number N00024-00-C-6103 awarded by the U.S. Navy. The government has certain rights in this invention.

TECHNICAL FIELD

[0002] The present invention relates generally to security systems, and more particularly to a security system in an aircraft terminal.

[0003] It is a constant goal in the field of security technology to improve airport terminal security. A problem often arises that an individual crossing through security checkpoints inadvertently (and often innocently) is permitted through with something they are not allowed to take into the secure area. The procedures for dealing with these types of situations are relatively expensive and include at least some of the following: evacuating the airport terminal, evacuating a flight, or re-screening passengers. The item and person is rarely, if ever, found, whereas flights are delayed and passengers are inconvenienced. The cost of such an event is often in the hundreds of thousands if not millions of dollars.

[0004] To avoid evacuating the entire airport terminal, security must do at least one of the following: find the person who breeched security, retrieve the banned item, verify that the occurrence was, in fact, not a breech of security, or verify that the person did not pass the item off to someone else or conceal it somewhere in the airport.

[0005] Often is the case that even though the security personnel review identification cards of everyone entering the screening area, they have no idea who these people are after they leave the screening area because the identification information is not recorded.

[0006] A further problem occurs in airport terminals because of lack of sufficient camera overlap such that although most terminals include many cameras, the cameras often do not have the desired overlap in field of view. This overlap would allow tracking of a person from camera to camera and allow a security breech to be traced back to its origin.

[0007] The disadvantages associated with current airport security systems made it apparent that a new technique for tracking potential security violations from security checkpoints is needed. The new technique should record data of people passing through the checkpoints and should also have sufficient camera overlap for tracking of the potential security breech.

SUMMARY OF THE INVENTION

[0008] According to one embodiment of the present invention, an airport security checkpoint system includes a scanner scanning and time stamping an article of identification of an individual passing into a secure terminal area. The system further includes first and second security cameras generating respective first and second video signals of first and second overlapping zones of coverage of the secure terminal area. The first video signal is recorded on a first recorder. The second video signal is recorded on a second recorder. The video signals are received in a controller generating a seamless video signal therefrom, whereby an indication of a security breach by the individual in the secure terminal area is tracked from the breach to the time stamp through reversing the seamless video signal.

[0009] According to another embodiment of the present invention, a method for operating an airport security system covering a secure terminal area includes generating overlapping images of the secure terminal area with a plurality of security cameras. The method further includes recording first identification information of a first individual entering the secure terminal area and time stamping the first identification information. Images of the first individual passing from the first one of the plurality of cameras to the second one of the plurality of cameras are recorded. A path of the first individual is retraced through the secure terminal area from the time stamping of the first identification information to real-time through reviewing the images.

[0010] One advantage of the present invention is that it generates a seamless video image that can be traced back to a time stamp for rapidly identifying a security violator.

[0011] Another advantage is that airport terminals having the present security system may avoid evacuations and thereby avoid large expenditures of money for rescheduled flights, passenger inconveniences, and unnecessary security searches.

[0012] Additional advantages and features of the present invention will become apparent from the description that follows and may be realized by the instrumentalities and combinations particularly pointed out in the appended claims, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] For a complete understanding of the invention, there will now be described some embodiments thereof, given by way of example, reference being made to the accompanying drawings, in which:

[0014] **FIG. 1** is a schematic diagram of an airport security system in accordance with one embodiment of the present invention; and

[0015] **FIG. 2** is a logic flow diagram illustrating operations of the system of **FIG. 1** in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION

[0016] The present invention is illustrated with respect to a security system, particularly suited to the field of airport security. The present invention is, however, applicable to various other uses that may require security systems, such as office buildings, banks, political event locations, and other locations or situations involving high traffic of people through a security checkpoint, as will be understood by one skilled in the art. In each of the following figures, the same reference numerals are used to refer to the same components.

[0017] Referring to **FIG. 1**, an airport security checkpoint system **10** including a security control system **12** is illustrated in accordance with one embodiment of the present invention. The airport security checkpoint system **10**

includes a command center **14** having a controller **70** and a plurality of digital recorders **16** coupled to a plurality of digital cameras **15** having collective fields of view **18** covering a secure terminal area **20**. The secure terminal area **20** is adjacent to a plurality of security lanes **22** each having a respective ID reader or scanner **24**. Further illustrated in **FIG. 1** is a security officer **26** screening an individual **28** at the security lanes **22**.

[**0018**] Each of the security lanes **22**, (here embodied as three: first security lane **30**, second security lane **32**, third security lane **34**), includes a respective ID reader or scanner (first scanner **36**, second scanner **38**, third scanner **40**). The security lanes **22** are embodied as typical security lanes and may include such things as metal detectors or x-ray machines. The security lanes **22** feed into the secure terminal area **20**, which is here represented as a rectangular block intended to be a typical secure airport terminal area.

[**0019**] Each identification (ID) reader or scanner **24** reads an article of identification, such as the names of people **28** entering the security lanes **22**, off their drivers license or passport. Alternately, a scanner or digital camera snaps a digital photograph of the ID as it is presented. All scans or photographs will include a time stamp such that information is recorded of who entered and at what time. In other embodiments, the scanner **24** scans boarding passes or other scannable articles including biological identifiers, such as retinas and fingerprints.

[**0020**] At this stage in the security process, if a breech occurs it may be narrowed down to a few individuals that can be asked to return to the security checkpoint **10**.

[**0021**] The system **10** further includes a network or plurality of cameras **13** having overlapping viewing areas of the secure terminal area **20**. Each of the plurality of cameras is coupled to at least one digital recorder **16** recording images from the cameras **13**. In other words, a first digital camera **42** generates signals covering a first zone of coverage **43** received in a first digital recorder **44**; a second digital camera **46** generates signals of the second zone of coverage **48** that are then received in the second digital recorder **50**; the third digital camera **52** receives signals from the third zone of coverage **54** that are then received in the third digital recorder **56**; the fourth digital camera **58** receives signals from the fourth zone of coverage **60** that are then received in the fourth digital recorder **62**; the fifth digital camera **64** receives signals from the fifth zone of coverage **66** that are then received in the fifth digital recorder **68**.

[**0022**] Signals from the digital recorders **16** and cameras **13** are received in the controller **70** that may include applications, such as automatic "fly-to" software or image recognition software, assisting in tracking a person from camera to camera. The controller **70** may be coupled to a user interface **72** including a monitor.

[**0023**] The system **10** provides a method for integrating overlapping video surveillance cameras **13** with video management software in the controller **70** for switching between camera views for aiding in the tracking of suspected individuals. This allows generation of a complete record of individuals passing through security checkpoints.

[**0024**] The system **10** incorporates a method for recording the video and playing back of the video with seamless switching between different camera recordings in a faster than real-time order, such that security personnel using the user interface **72** may catch up with a suspected individual. In other words, the security personnel detect a security breach and rewind film from all the cameras for tracking the individual or individuals (e.g. first individual and second individual) responsible back to that individual's point of entry into the secure area **20**. The identification time stamp may be then used to identify the individual. For example, the individual's whereabouts and activities may be determined through forwarding the film from the plurality of cameras **13**.

[**0025**] In an alternate embodiment of the present invention, the controller **70** includes image recognition software, such that the controller automatically tracks the individual to the point of entry or time stamp and automatically provides security personnel with identification information and current whereabouts information.

[**0026**] Referring to **FIG. 2**, a logic flow diagram **80** of a method for operating a security system, in accordance with another embodiment of the present invention, is illustrated. Logic starts in operation block **82** where the cameras generate overlapping images of the secure terminal area.

[**0027**] In operation block **84** an individual enters the secure terminal area through the security lanes by providing identification information, which is recorded and time stamped.

[**0028**] In operation block **85**, a security breach is detected by security personnel.

[**0029**] In operation block **86** the individual responsible for the security breach is tracked from camera to camera by rewinding the film of the cameras or through tracking software in the controller.

[**0030**] In operation block **88** images are recorded of the individual passing from camera to camera for use as evidence of security breach.

[**0031**] In operation block **90** the path of the individual through the secure terminal area is retraced from the moment and point of entry to real-time.

[**0032**] From the foregoing, it can be seen that there has been brought to the art a new security system. It is to be understood that the preceding description of one embodiment of the present invention is merely illustrative of some of the many specific embodiments that represent applications of the principals of the present invention. Numerous and other arrangements would be evident to those skilled in the art without departing from the scope of the invention as defined by the following claims.

What is claimed is:

1. An airport security checkpoint system comprising: a scanner scanning an article of identification from an individual and generating a time stamp signal for said article of identification, said individual passing into a secure terminal area; a first security camera generating a first video signal of a first zone of coverage of said secure terminal area; a first recorder recording said first video signal; a second security camera generating a second video signal of a second zone of coverage overlapping said first zone of coverage of said secure terminal area; a second recorder recording said second video signal; and a controller receiving said first video signal and said second video signal, said controller

generating a seamless video signal from said first video signal and said second video signal, whereby an indication of a security breach by said individual in said secure terminal area is tracked from said breach to said passing in of said individual into said secure terminal area through reversing said seamless video signal.

2. The system of claim 1, further comprising a plurality of security cameras covering an entire area of said secure terminal area.

3. The system of claim 2 further comprising a plurality of digital recorders, each of said plurality of digital recorders storing signals from a respective one of said plurality of security cameras.

4. The system of claim 2, wherein said controller comprises object recognition software recognizing said individual.

5. The system of claim 4, wherein said controller stores image recognition data of said individual and scans said image recognition data in response to said security breach.

6. The system of claim 5, wherein said controller automatically scans said image recognition data from said time stamp to real-time and generates a real-time signal of said individual.

7. The system of claim 5, wherein said seamless video signal is reversed and forwarded by security personnel tracking said individual and analyzing said security breach.

8. The system of claim 5, wherein said controller generates an automatic fly to signal on a monitor of said individual's real-time whereabouts.

9. The system of claim 5, wherein said article of identification comprises at least one of a driver's license, a state ID, a passport, a boarding pass, and a biological identifier.

10. A method for operating an airport security system covering a secure terminal area comprising: generating overlapping images of the secure terminal area with a plurality of security cameras; recording first identification information of a first individual entering the secure terminal area; time stamping said first identification information; recording images of said first individual passing from said first one of said plurality of cameras to said second one of said plurality of cameras; and retracing a path of said first individual through the secure terminal area from said time stamping of said first identification information to real-time through reviewing said images.

11. The method of claim 10 further comprising tracking said first individual from a first one of said plurality of cameras to a second one of said plurality of cameras with a tracking software.

12. The method of claim 10 further comprising recording second identification information of a second individual entering the secure terminal area; and time stamping said second identification information.

13. The method of claim 10 further comprising automatically flying to said time stamping of said first identification information and said real-time.

14. The method of claim 10 further comprising generating a seamless image of first individual passing from said first one of said plurality of cameras to said second one of said plurality of cameras.

15. The method of claim 14, wherein retracing comprises reversing said seamless image through a manual interface.

16. The method of claim 10, wherein retracing comprises recognizing an image of said first individual through image recognition software.

17. An airport security checkpoint system comprising: a plurality of security lanes comprising security devices; a plurality of identification scanners coupled to said plurality of security lanes and scanning identifications of people entering a secure terminal area and generating time stamp signals for each of said identifications; a plurality of security cameras generating a plurality of video signal of a plurality of overlapping zones of coverage of said secure terminal area; a plurality of recorders recording said plurality of video signals; and a controller receiving said plurality of video signals and generating a seamless video signal therefrom, said controller further receiving said time stamp signals such that said seamless video is reversed to any one of said time stamp signals and forwarded to real-time, said controller further comprising image recognition algorithms recognizing each of said plurality of individuals.

18. The system of claim 17, further comprising a plurality of security cameras covering an entire area of said secure terminal area.

19. The system of claim 17, wherein said controller stores image recognition data of said individual and scans said image recognition data in response to said security breach.

20. The system of claim 17, wherein said controller automatically scans said image recognition data from said time stamps to real-time and generates a real-time signal of said individual.

21. The system of claim 17 further comprising a user interface such that security personnel reverse and forward said seamless video signal analyzing said security breach.

22. The system of claim 17, wherein said controller generates an automatic fly to signal on a monitor of one of said plurality of individuals' real-time whereabouts.

23. The system of claim 17, wherein said article of identification comprises at least one of a driver's license, a state ID, a passport, a boarding pass, and a biological identifier.

24. The system of claim 17, wherein said security devices comprise metal detectors and x-ray machines.

25. The system of claim 17, wherein said controller flags suspicious members of said plurality of individuals.

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