METHODS AND APPARATUS TO MONITOR AND MANAGE LOADING DOCKS AND FACILITY OPERATIONS

FIELD OF THE DISCLOSURE

[0001] This disclosure relates generally to monitoring systems, and, more particularly, to methods and apparatus to monitor and manage loading docks and facility operations.

BACKGROUND

[0002] Loading docks provide an area for vehicles (e.g., trucks, trailers, etc.) to move next to an elevated platform of a building (e.g., a material handling facility) so that cargo can be readily transferred between the vehicle and the building. Some loading docks include equipment such as dock levelers, vehicle restraints, and/or dock doors, any of which may be associated with one or more sensor/monitoring systems. Within material handling facilities there may be additional equipment to facilitate the movement, storage, and/or handling of cargo such as, for example, grade-level doors, HVAC (heating, ventilation, and air conditioning) systems, industrial doors to partition freezer rooms and/or other rooms, conveyor systems, fans for air movement within the facility, lighting and signal systems, etc.

SUMMARY

[0002a] According to a first aspect of the present invention, there is provided an apparatus to monitor operations at a material handling facility, the apparatus including: an IO network interface to obtain IO data communicated from a controller associated with a dock of the material handling facility, the IO data including first data and second data; an event analyzer to: determine, based on the first data, whether a truck trailer is present at the dock of the material handling facility; and determine, based on the second data, a condition associated with equipment at the dock, the second data being different than the first data, the event analyzer to be remote from the controller; a web server to host a web page accessible by a client device remote from the dock and remote from the event analyzer and a notification generator to generate a notification based on whether the truck trailer is present and the condition associated with the equipment at the dock, the web page to include information associated with the notification.

[0002b] There is provided an apparatus to monitor operations at a material handling facility, the apparatus including: a data analyzer to: monitor first data indicative of when a door associated with the material handling facility is

in a non-closed state; monitor second data indicative of passage of at least one of a person or an object through a doorway associated with the door in the non-closed state; and a notification generator to generate a notification in response to the second data indicating no passage of at least one of the person or the object through the doorway during a duration of time in which the first data indicates the door is in the non-closed state, the notification indicative of a false activation of the door.

[0002c] There is provided an apparatus to monitor operations at a material handling facility, the apparatus including: a database to aggregate dock data associated with a plurality of docks of the material handling facility, the dock data including (1) an indication of operational states of equipment associated with the plurality of docks, (2) an indication of activity of personnel in proximity of the plurality of docks based on feedback from sensors associated with the plurality of docks, and (3) load information associated with trailers to be at least one of loaded or unloaded at ones of the plurality of docks; and a notification generator to: render a plurality of dock icons corresponding to the plurality of docks; and in response to a user selecting a first dock icon of the plurality of dock icons, render a menu of options for the user to select, the options presented in the menu to be dynamically updated based on the dock data.

[0002d] According to a second aspect of the present invention, there is provided a computer readable medium comprising instructions that, when executed, cause a processor to at least: obtain IO data communicated from a controller associated with a dock of a material handling facility, the IO data including first data and second data, the processor to be remote from the controller; determine, based on the first data, whether a truck trailer is present at the dock of the material handling facility; determine, based on the second data, a condition associated with equipment at the dock, the second data being different than the first data; host a web page accessible by a client device remote from the dock and remote from the processor; and generate a notification based on whether the truck trailer is present and the condition associated with the equipment at the dock, the web page to include information associated with the notification.

[0002e] There is provided a non-transitory computer readable medium comprising instructions that, when executed, cause a process to at least: monitoring first data indicative of when a door associated with the material handling facility is in a non-closed state; monitoring second data indicative of passage of at least one of

a person or an object through a doorway associated with the door in the non-closed state; and generating a notification in response to the second data indicating no passage of at least one of the person or the object through the doorway while the first data indicates the door is in the non-closed state, the notification indicative of a false activation of the door.

[0002f] There is provided a non-transitory computer readable medium comprising instructions that, when executed, cause a process to at least: aggregating dock data associated with a plurality of docks of the material handling facility, the dock data including (1) an indication of operational states of equipment associated with the plurality of docks, (2) an indication of activity of personnel in proximity of the plurality of docks based on feedback from sensors associated with the plurality of docks, and (3) load information associated with trailers to be at least one of loaded or unloaded at ones of the plurality of docks; rendering a plurality of dock icons corresponding to the plurality of docks; and in response to a user selecting a first dock icon of the plurality of dock icons, rendering a menu of options for the user to select, the options presented in the menu dynamically updated based on the dock data.

[0002g] According to a third aspect of the present invention, there is provided a method to monitor operations at a material handling facility, the method including: obtaining IO data communicated from a controller associated with a dock of the material handling facility, the IO data including first data and second data; determining, by executing an instruction with processor circuitry and based on the first data, whether a truck trailer is present at the dock of the material handling facility, the processor circuitry to be remote from the controller; and determining, by executing an instruction with the processor circuitry and based on the second data, a condition associated with equipment at the dock, the second data being different than the first data; hosting a web page accessible by a client device remote from the dock and remote from the processor circuitry; and generating a notification based on whether the truck trailer is present and the condition associated with the equipment at the dock, the web page to include information associated with the notification.

[0002h] There is provided a method to monitor operations at a material handling facility, the method including: monitoring first data indicative of when a door associated with the material handling facility is in a non-closed state; monitoring second data indicative of passage of at least one of a person or an object through a doorway associated with the door in the non-closed state; and generating a notification in

response to the second data indicating no passage of at least one of the person or the object through the doorway while the first data indicates the door is in the non-closed state, the notification indicative of a false activation of the door.

[0002i] There is provided a method to monitor operations at a material handling facility, the method including: aggregating dock data associated with a plurality of docks of the material handling facility, the dock data including (1) an indication of operational states of equipment associated with the plurality of docks, (2) an indication of activity of personnel in proximity of the plurality of docks based on feedback from sensors associated with the plurality of docks, and (3) load information associated with trailers to be at least one of loaded or unloaded at ones of the plurality of docks; rendering a plurality of dock icons corresponding to the plurality of docks; and in response to a user selecting a first dock icon of the plurality of dock icons, rendering a menu of options for the user to select, the options presented in the menu dynamically updated based on the dock data.

[0002j] There is provided an apparatus including: an IO network interface to receive IO data reported from a controller associated with a material handling facility, the IO data including a value for an IO parameter monitored by the controller; a web server to provide a first web page to a first client device and a second web page to a second client device, the second web page different than the first web page, the first web page including first information based on the value of the IO parameter, the second web page including second information based on the value of the IO parameter, the web server to receive user input data entered via the first web page; and a push service manager to push the user input data to the second web page, the second information to be updated based on the user input data.

[0002k] There is provided an apparatus including: an IO network interface to receive IO data reported from a controller associated with a material handling facility; a web server to provide a first web page to a first client device and a second web page to a second client device, the second web page different than the first web page; and a push service manager to push the IO data to both the first and second web pages based on a common string included in both the first and second web pages, the common string identifying a data stream to which the first and second web pages subscribe, the data stream associated with the IO data reported from the controller.

[0002l] There is provided a system to monitor operation of a door associated with a material handling facility, including: a first sensor

to generate a first output, the first output indicating when the door is in a non-closed state; a second sensor to generate a second output, the second output indicating passage of at least one of a person or an object through a doorway associated with the door in the non-closed state; and a processor to receive the first and second outputs, the processor to detect a false activation of the door when the second output is not generated by the second sensor while the first output indicates the door is in the non-closed state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] FIG. 1 illustrates an example material handling facility in which teachings disclosed herein may be implemented.

[0004] FIG. 2 illustrates the example loading dock of FIG. 1 viewed from an exterior of the material handling facility.

[0005] FIG. 3 illustrates the example loading dock of FIG. 1 viewed from an interior of the material handling facility with a trailer parked at the dock.

[0006] FIG. 4 illustrates a cross-sectional side view of the example loading dock of FIG. 1 with the associated trailer of FIG. 3.

[0007] FIG. 5 is a block diagram of the example management server(s) of FIG. 1.

[0008] FIG. 6 is a block diagram of the example main server of FIG. 1.

[0009] FIG. 7 is a block diagram of an example database associated with the example main server of FIG. 1.

What Is Claimed Is:

1. An apparatus to monitor operations at a material handling facility, the apparatus comprising:

an IO network interface to obtain IO data communicated from a controller associated with a dock of the material handling facility, the IO data including first data and second data;

an event analyzer to:

determine, based on the first data, whether a truck trailer is present at the dock of the material handling facility; and

determine, based on the second data, a condition associated with equipment at the dock, the second data being different than the first data, the event analyzer to be remote from the controller;

a web server to host a web page accessible by a client device remote from the dock and remote from the event analyzer; and

a notification generator to generate a notification based on whether the truck trailer is present and the condition associated with the equipment at the dock, the web page to include information associated with the notification.

2. The apparatus of claim 1, wherein the first data is generated by a first data source and the second data is generated by a second data source, the first data source being different than the second data source, the first data source corresponding to at least one of a first sensor at the dock, a vehicle restraint at the dock, a leveler at the dock, a light indicator, or a database for a dock management system associated with the material handling facility, the second data source corresponding to at least one of a second sensor at the dock different than the first sensor, the vehicle restraint, the leveler, the light indicator, or the database.

3. The apparatus of claim 2, wherein the second data source corresponds to the second sensor, the second sensor to monitor operation of a door, the condition corresponding to whether the door is in a non-closed state, the notification generator to generate the notification when the first data indicates the trailer is not present at the dock while the second data indicates the door is in the non-closed state, the notification indicative of a drop-off hazard associated with the door.

4. The apparatus of claim 3, wherein the event analyzer is to:

determine, based on third data, whether a barrier is blocking passage through a doorway associated with the door in the non-closed state, the barrier being different than the door; and

inhibit generation of the notification when the third data indicates the barrier is blocking passage through the doorway.

5. The apparatus of claim 2, wherein the second data source corresponds to the light indicator, the light indicator to switch between a first state when the vehicle restraint is in an engaged position and a second state when the vehicle restraint is in a stored position, the vehicle restraint to engage the trailer at the dock when the vehicle restraint is in the engaged position, the light indicator to switch to the first state when the vehicle restraint is put into an override mode regardless of whether the vehicle restraint is in the engaged position or the stored position, the notification generator to generate the notification in response to (1) the first data indicating the trailer is not present at the dock and (2) the second data indicating the light indicator is in the first state associated with the vehicle restraint being in the override mode, the notification indicative of the trailer being pulled away from the dock when the light indicator was in the first state.

6. The apparatus of claim 2, wherein the second data source corresponds to the database, the database to store dock management data indicative of an assignment of different trailers to different docks of the material handling facility, the notification generator to generate the notification in response to the first data indicating the trailer is present at the dock when the second data indicates no trailer is assigned to the dock, the notification indicative of the trailer being at a wrong dock.

7. The apparatus of claim 2, wherein the second data source corresponds to the second sensor, the second sensor to monitor activity within the trailer at the dock, the condition corresponding to a duration of non-activity sensed within the trailer, the notification generator to generate the notification in response to the duration exceeding a threshold.

8. The apparatus of claim 2, wherein the event analyzer is to identify, based on third data, a user activation of a manually-initiated actuator that enables operation of first equipment associated with the dock, the second data source corresponding to the second sensor, the second sensor to monitor a state of second equipment in an interlock relationship with the operation of the first equipment, the condition corresponding to whether the state of the second equipment prevents the operation of the first equipment based on the interlock relationship, the notification generator to generate the notification in response to the user activation while the second data indicates the state of the second equipment prevents the operation of the first equipment.

9. The apparatus of claim 1, wherein the notification generator is to render information associated with the notification on a screen located proximate the dock.

10. The apparatus of claim 1, further including an event logger to log an event in a database, the event associated with a content of the notification.

11. The apparatus of claim 1, wherein the dock is a first dock, the controller is a first controller, the IO data is first IO data, and the IO network interface is to obtain second IO data from a second controller associated with a second dock of the material handling facility, the web page to include information based on both the first IO data and the second IO data.

12. The apparatus of claim 11, wherein the IO network interface obtains the first IO data and the second IO data via wireless communications from the first controller and the second controller.

13. The apparatus of claim 1, further including a network communications interface to transmit the notification to the client devices independent of the web page.

14. The apparatus of claim 1, wherein the web page is a first web page, the web server to host a second web page accessible by the client device, the second web page different than the first web page, the notification generator including a push service manager to automatically update information presented on the second web page based on user input data received via the first web page.

15. The apparatus of claim 1, wherein the web page is a first web page, the web server to host a second web page accessible by the client device, the second web page different than the first web page, the notification generator including a push service manager to push the IO data to both the first and second web pages based on a common string included in both the first and second web pages, the common string identifying a data stream to which the first and second web pages subscribe, the data stream associated with the IO data reported from the controller.

16. A computer readable medium comprising instructions that, when executed, cause a processor to at least:

obtain IO data communicated from a controller associated with a dock of a material handling facility, the IO data including first data and second data, the processor to be remote from the controller;

determine, based on the first data, whether a truck trailer is present at the dock of the material handling facility;

determine, based on the second data, a condition associated with equipment at the dock, the second data being different than the first data;

host a web page accessible by a client device remote from the dock and remote from the processor; and

generate a notification based on whether the truck trailer is present and the condition associated with the equipment at the dock, the web page to include information associated with the notification.

17. The computer readable medium of claim 16, wherein the first data is generated by a first data source and the second data is generated by a second data source, the first data source being different than the second data source, the first data source corresponding to at least one of a first sensor at the dock, a vehicle restraint at the dock, a leveler at the dock, a light indicator, or a database for a dock management system associated with the material handling facility, the second data source corresponding to at least one of a second sensor at the dock different than the first sensor, the vehicle restraint, the leveler, the light indicator, or the database.

18. The computer readable medium of claim 17, wherein the second data source corresponds to the second sensor, the second sensor to monitor operation of a door, the condition corresponding to whether the door is in a non-closed state, the instructions further causing the processor to generate the notification when the first data indicates the trailer is not present at the dock while the second data indicates the door is in the non-closed state, the notification indicative of a drop-off hazard associated with the door.

19. The computer readable medium of claim 18, wherein the instructions further cause the processor to:

determine, based on third data, whether a barrier is blocking passage through a doorway associated with the door in the non-closed state, the barrier being different than the door; and

inhibit generation of the notification when the third data indicates the barrier is blocking passage through the doorway.

20. The computer readable medium of claim 17, wherein the second data source corresponds to the light indicator, the light indicator to switch between a first state when the vehicle restraint is in an engaged position and a second state when the vehicle restraint is in a

stored position, the vehicle restraint to engage the trailer at the dock when the vehicle restraint is in the engaged position, the light indicator to switch to the first state when the vehicle restraint is put into an override mode regardless of whether the vehicle restraint is in the engaged position or the stored position, the instructions further causing the processor to generate the notification in response to (1) the first data indicating the trailer is not present at the dock and (2) the second data indicating the light indicator is in the first state associated with the vehicle restraint being in the override mode, the notification indicative of the trailer being pulled away from the dock when the light indicator was in the first state.

21. The computer readable medium of claim 17, wherein the second data source corresponds to the database, the database to store dock management data indicative of an assignment of different trailers to different docks of the material handling facility, the instructions further causing the processor to generate the notification in response to the first data indicating the trailer is present at the dock when the second data indicates no trailer is assigned to the dock, the notification indicative of the trailer being at a wrong dock.

22. The computer readable medium of claim 17, wherein the second data source corresponds to the second sensor, the second sensor to monitor activity within the trailer at the dock, the condition corresponding to a duration of non-activity sensed within the trailer, the instructions further causing the processor to generate the notification in response to the duration exceeding a threshold.

23. The computer readable medium of claim 17, wherein the instructions further cause the processor to:

identify, based on third data, a user activation of a manually-initiated actuator that enables operation of first equipment associated with the dock, the second data source corresponding to the second sensor, the second sensor to monitor a state of second equipment in an interlock relationship with the operation of the first equipment, the condition corresponding to whether the state of the second equipment prevents the operation of the first equipment based on the interlock relationship; and

generate the notification in response to the user activation while the second data indicates the state of the second equipment prevents the operation of the first equipment.

24. The computer readable medium of claim 16, wherein generating the notification includes rendering information associated with the notification on a screen located proximate the dock.

25. The computer readable medium of claim 16, wherein the dock is a first dock, the controller is a first controller, the IO data is first IO data, and the instructions further cause the processor to obtain second IO data from a second controller associated with a second dock of the material handling facility, the web page to include information based on both the first IO data and the second IO data.

26. The computer readable medium of claim 16, wherein the instructions further cause the processor to cause transmission of the notification to the client devices independent of the web page.

27. The computer readable medium of claim 16, wherein the web page is a first web page, and the instructions further cause the processor to:

host a second web page accessible by the client device, the second web page different than the first web page; and

automatically update information presented on the second web page based on user input data received via the first web page.

28. The computer readable medium of claim 16, wherein the web page is a first web page, and the instructions further cause the processor to:

host a second web page accessible by the client device, the second web page different than the first web page; and

push the IO data to both the first and second web pages based on a common string included in both the first and second web pages, the common string identifying a data stream to which the first and second web pages subscribe, the data stream associated with the IO data reported from the controller.

29. A method to monitor operations at a material handling facility, the method comprising:

obtaining IO data communicated from a controller associated with a dock of the material handling facility, the IO data including first data and second data;

determining, by executing an instruction with processor circuitry and based on the first data, whether a truck trailer is present at the dock of the material handling facility, the processor circuitry to be remote from the controller;

determining, by executing an instruction with the processor circuitry and based on the second data, a condition associated with equipment at the dock, the second data being different than the first data;

hosting a web page accessible by a client device remote from the dock and remote from the processor circuitry; and

generating a notification based on whether the truck trailer is present and the condition associated with the equipment at the dock, the web page to include information associated with the notification.

30. The method of claim 29, wherein the first data is generated by a first data source and the second data is generated by a second data source, the first data source being different than the second data source, the first data source corresponding to at least one of a first sensor at the dock, a vehicle restraint at the dock, a leveler at the dock, a light indicator, or a database for a dock management system associated with the material handling facility, the second data source corresponding to at least one of a second sensor at the dock different than the first sensor, the vehicle restraint, the leveler, the light indicator, or the database.

31. The method of claim 30, wherein the second data source corresponds to the second sensor, the second sensor to monitor operation of a door, the condition corresponding to whether the door is in a non-closed state, the method further including generating the notification when the first data indicates the trailer is not present at the dock while the second data indicates the door is in the non-closed state, the notification indicative of a drop-off hazard associated with the door.

32. The method of claim 31, further including:

determining, based on third data, whether a barrier is blocking passage through a doorway associated with the door in the non-closed state, the barrier being different than the door; and

inhibiting generation of the notification when the third data indicates the barrier is blocking passage through the doorway.

33. The method of claim 30, wherein the second data source corresponds to the light indicator, the light indicator to switch between a first state when the vehicle restraint is in an engaged position and a second state when the vehicle restraint is in a stored position, the vehicle restraint to engage the trailer at the dock when the vehicle restraint is in the engaged position, the light indicator to switch to the first state when the vehicle restraint is put into an override mode regardless of whether the vehicle restraint is in the engaged position or the stored position, the method further including generating the notification in response to (1) the first data indicating the trailer is not present at the dock and (2) the second data indicating the light indicator is in the first state associated with the vehicle restraint being in the override

mode, the notification indicative of the trailer being pulled away from the dock when the light indicator was in the first state.

34. The method of claim 30, wherein the second data source corresponds to the database, the database to store dock management data indicative of an assignment of different trailers to different docks of the material handling facility, the method further including generating the notification in response to the first data indicating the trailer is present at the dock when the second data indicates no trailer is assigned to the dock, the notification indicative of the trailer being at a wrong dock.

35. The method of claim 30, wherein the second data source corresponds to the second sensor, the second sensor to monitor activity within the trailer at the dock, the condition corresponding to a duration of non-activity sensed within the trailer, the method further including generating the notification in response to the duration exceeding a threshold.

36. The method of claim 30, further including:

determining, based on third data, a user activation of a manually-initiated actuator that enables operation of first equipment associated with the dock, the second data source corresponding to the second sensor, the second sensor to monitor a state of second equipment in an interlock relationship with the operation of the first equipment, the condition corresponding to whether the state of the second equipment prevents the operation of the first equipment based on the interlock relationship; and

generating the notification in response to the user activation while the second data indicates the state of the second equipment prevents the operation of the first equipment.

37. The method of claim 29, wherein generating the notification includes rendering information associated with the notification on a screen located proximate the dock.

38. The method of claim 29, wherein the dock is a first dock, the controller is a first controller, the IO data is first IO data, and the method further includes obtaining second IO data from a second controller associated with a second dock of the material handling facility, the web page to include information based on both the first IO data and the second IO data.

39. The method of claim 38, wherein the obtaining of the first IO data and the second IO data is accomplished via wireless communications from the first controller and the second controller.

40. The method of claim 29, further including transmitting the notification to the client devices independent of the web page.

41. The method of claim 29, wherein the web page is a first web page, and the method further includes:

hosting a second web page accessible by the client device, the second web page different than the first web page; and

automatically updating information presented on the second web page based on user input data received via the first web page.

42. The method of claim 29, wherein the web page is a first web page, and the method further includes:

hosting a second web page accessible by the client device, the second web page different than the first web page; and

pushing the IO data to both the first and second web pages based on a common string included in both the first and second web pages, the common string identifying a data stream to which the first and second web pages subscribe, the data stream associated with the IO data reported from the controller.