

Method And System For Aggregating And Transferring Data From Multiple ID Readers Over An Adhoc Wireless Network

Field of Invention

[0001] The present invention relates to a system and method for processing and transferring ID data from different ID readers so that ID data is operable to be transmitted over an adhoc wireless network.

Background

[0002] ID technology (radio-frequency identifications (or RFID), barcodes, smart cards and biometrics, etc.) has revolutionised businesses such as supply chain and inventory management by benefiting all parts of the distribution chain - the manufacturer, supplier, carrier, retail and consumer. The implications of ID when applied in business results in increased efficiencies and more effective distribution chains including inventory control, asset tracking and asset utilisation, documentation flow, customer service; all theses also translate into higher productivity and reduced business costs. However, in spite of the optimism, a sense of caution pervades the adoption and deployment of ID technology. One of the major reason stems from the high cost of setting up the infrastructure of multiple readers to read different types of ID tags.

[0003] The current hard-wired infrastructures for ID readers especially for large area deployments, such as warehouses, are complex. Such infrastructure poses many limitations in terms of flexibility, ease of deployment and cost. Scalability is also a key issue in future expansion and extension of a wired network.

[0004] US Patent No. 6,415,978, assigned to PSC Scanning, Inc., describes a multiple technology data reader. The multiple technology data reader includes a bar code reader and an RFID reader, each is connected to a device microcontroller. The device microcontroller includes a bar-code preprocessor and an RFID pre-processor, each of which are connected to a decoding and control means. The decoding and control means

is connected to a device communication, control and power unit. The device microcontroller is connected to a host computer via a USB.

[0005] US Patent No. 6,318,636, assigned to Intermec IP Corp., describes a data carrier reader for reading RFID tags and machine readable symbols. The reader is in communication with a host, which can command the reader to toggle between an RFID mode and a symbol reading mode.

[0006] Despite development in ID technology, it can thus be seen that there exists a need for a new ID system that is scalable and method for supporting different ID readers in an enterprise ID system.

Summary

[0007] The following presents a simplified summary to provide a basic understanding of the present invention. This summary is not an extensive overview of the invention, and is not intended to identify key features of the invention. Rather, it is to present some of the inventive concepts of this invention in a generalised form as a prelude to the detailed description that is to follow.

[0008] The present invention seeks to provide a wireless 'infrastructure-less' or adhoc ID network to address the high cost of conventional hard-wired closed-loop network. With an integration of multiple ID readers (such as RFID and Barcode for inventory & control tracking, Smart Card and Biometric for security and authentication) in the 'infrastructure-less' ID network system, the present invention also provides enterprises with an effective and efficient ID solution, which does not require the set up of a pre-fixed infrastructure yet is scalable to meet future needs.

[0009] In one embodiment, the present invention provides a system for ID data/symbol reading, and transferring the ID data/symbol via a network to a backend station for processing. The system comprises: a universal ID processor having a plurality of reader ports, wherein said one reader port is operable to be connected to an ID reader; and

another universal ID processor disposed at a backend station; wherein: said universal ID processor and said backend universal ID processor each has a controller and a wireless transceiver; and ID data/symbol read by an ID reader is coded in a port header and a node header by said controller associated with said universal ID processor to form a data packet, so that said data packet is then operable to be transmitted by said wireless transceiver to said backend universal ID processor for processing.

[0010] In another embodiment, the present invention provides a method for reading ID data/symbol, coding the ID data/symbols for transmission over a structure-less network to a backend station for decoding. The method comprises: connecting an ID reader to a universal ID processor via a reader port; coding the ID data/symbol captured by the ID reader into a port header and node header associated with the universal ID processor to form a data packet; and transmitting said data packet to a universal ID processor disposed at a backend station for decoding and processing.

[0011] In another embodiment, the present invention provides a universal ID processor. The universal ID processor comprises: a plurality of reader ports, each reader port being operable for connection with an ID data/symbol reader; a controller in connection with the plurality of reader ports for assembling all the ID data/symbol read by the ID readers into a data packet; and a transceiver for transmitting said data packet to a backend universal ID processor or relaying another data packet via an adjacent universal ID processor to the backend universal ID processor.

[0012] In an embodiment of the universal ID processor, the universal ID processor comprises an ID-type switch associated with each reader port, wherein a logical address of the ID-type switch is unique to the ID reader type that is connectable to the relevant reader port. In another embodiment, the wireless transceiver is operable in an infrastructure-less or adhoc network linking one or more universal ID processor and with the backend universal ID processor.

[0013] In another embodiment, the ID reader includes any one of the following types: radio-frequency ID, biometric ID, smart card and barcode. In yet another embodiment, the ID reader includes a new generation reader; adding a new generation reader

comprises configuring a reader port to support the new generation ID reader, setting the ID-type switch accordingly and updating the controller with an upgraded firmware for the new generation ID reader.

Brief Description of the Drawings

[0014] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0015] FIG. 1 illustrates part of a group of universal ID processors in an enterprise ID system according to an embodiment of the present invention;

[0016] FIG. 2A illustrates an example of a look-up table for identification of types of ID readers supported by the enterprise ID system shown in FIG. 1;

FIG. 2B illustrates a lookup table for identification of a firmware version for the ID reader types shown in FIG. 2A;

[0017] FIG. 3 illustrates a configuration process for the universal ID processor according to another embodiment of the present invention;

[0018] FIGs. 4A-4B illustrate ID data coding process according to another embodiment of the present invention; FIGs. 4C-4E illustrate structures of the port header, node header and data packet used in the data coding process; FIGs. 4F and 4G illustrate details of a data packet transmitted between universal ID processors at nodes 1 and 2;

[0019] FIGs. 5A and 5B illustrate a data decoding process according to yet another embodiment of the present invention.

Detailed Description

[0020] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0021] FIG. 1 shows part of a system 10 of universal ID processors 20a,20b, 20bes, etc. according to an embodiment of the present invention. The system 10 of universal ID processors as shown in FIG. 1 forms part of an enterprise ID system 12. Each universal ID processor 20a,20b, etc. has a plurality N of reader ports 22a,22b,22c, etc., a controller 24a,24b, etc. and a wireless transceiver 26a,26b, etc. linked to the controller 24a,24b, etc.. Associated with each reader port 22a,22b,22c, etc. is an ID-type switch 23a,23b,23c, etc. In one embodiment, the ID-type switch 23a,23b, etc. is a dip switch.

[0022] As can be seen in FIG. 1, the universal ID processors 20a,20b, etc. are in an infrastructure-less wireless communication 30 network with a universal ID processor 20bes at a backend station, either directly and/or in a relay manner through some of the universal ID processors 20a,20b, etc. The backend universal ID processor 20bes in turn is coupled to a computer 28 of the enterprise ID system 12. Prior to use, a universal ID processor 20a,20b,20bes, etc. need to be configured. Such configuration 300, shown in FIG. 3, allows the universal ID processors 20a,20b, etc. to establish the infrastructure-less wireless network 30 or adhoc network for the coding and transfer of ID data or symbols from the universal ID processors to the backend universal ID processor 20bes. An advantage of the present invention is that several types of ID readers 15 can be added to or removed from the system 10 according to any configuration of the enterprise ID system 12. The ID readers 15 may include any new generation readers. The other advantage is that the wireless network 30 does not require any specific structure; hence, an adhoc network, operating for example at any unlicensed

bandwidth, is sufficient to implement the enterprise ID system 12 of the present invention.

[0023] Prior to use of each universal ID processors 20a,20b,20bes, etc., each universal ID processor needs to be configured 300 for connection with predetermined types of ID readers 15. The number of each type of ID reader is also predetermined; this number can be changed by re-configuring the relevant universal ID processor. To identify each type of ID readers 15 that is connected or to be connected to a reader port 22a,22b,22c, etc., each ID reader type is assigned unique logical bits or address; accordingly, the ID-type switch 23a,23b, etc. at each reader port is correspondingly set to the logical bits/address so that the reader type is electronically detectable by the associated controller. To record identification of an ID reader type, an ID-type look-up table 200 is formed.

[0024] FIG. 2A illustrates an example of an ID-type look-up table 200. As shown in FIG. 2A, two binary bits are used to set four different logic levels in order to identify four different ID readers 15 that are connected or to be connected to the respective reader ports 22a,22b,etc.. In other words, with two binary bits, four different ID readers 15, namely, RFID readers, biometric readers, smart card readers and barcode readers can be identified. In another embodiment, more than two binary bits are used to identify more than four different types of ID readers 15; For example, with 3 binary bits, a total of 8 different types of ID readers can be supported. With a predetermined types of ID readers to be supported by the enterprise ID system 12, a corresponding firmware 210, such as that shown in FIG. 2B, is loaded into the controller 24a,24b,etc. of each universal ID processor 20a,20b,20bes, etc.

[0025] As shown in FIG. 3, the configuration process 300 of each universal ID processor 20a,20b,20bes, etc. is manually implemented and starts with step 310. In the following step, a determination 320 is made whether an ID reader type is supported. If an ID reader type is supported, i.e. the ID reader type is included in the ID-type look-up table 200, the ID-type switches 23a,23b,23c,etc. are set, in step 350, according to the ID-type look-up table 200 and the configuration process 300 ends in step 360. However, if the determination in step 320 is negative, meaning that a new ID reader

type not included in the ID-type lookup table 200 is to be connected to the enterprise ID system 12, the new ID reader type is then registered and the ID-type look-up table 200 is updated, in step 330. Following this, the firmware is upgraded and loaded into the relevant controller 24a,24b,24bes,etc., in step 340; accordingly, the firmware lookup table 210 is also updated. In the next step 350, the ID-type switches 23a,23b,etc. are set according to the updated ID-type look-up table 200, and the configuration 300 process ends in step 360. The number of reader ports 22a,22b,22c,etc. that are configured for an ID reader type depends on the number of reader ports and on each implementation. If there is a change in the number of ID readers 15, a universal ID processor 20a,20b,etc. can be re-configured 300 again. Alternatively, additional universal ID processors can be added to the enterprise ID system 12.

[0026] FIGs. 4A and 4B illustrate a coding process 400 according to another embodiment of the present invention. After the system 10 of universal ID processors 20a,20b, etc. and the backend station are set up, and some ID readers 15 are connected to the reader ports 22a,22b,etc, the enterprise ID system 12 is ready for use. In use, the ID data/symbol coding process 400 shown in FIG. 4A, is executed by the respective controller 24a,24b, etc. by periodic scanning of the reader ports 22a,22b,etc.

[0027] As shown in FIG. 4A, a scan of the ID data coding process 400 starts with step 405. In the following step 410, a decision is made whether reader port number 1 is connected to an ID reader 15. If the decision is positive, process A shown in FIG. 4B, is executed in step 415 to code the ID data/symbol captured by the ID reader connected to reader port number 1 to a port header number 1; if the decision 410 is negative, for example the reader port is not connected to an ID reader, the next port is checked, in step 440, whether reader port number 2 is connected to an ID reader. This coding process 400 checks all the reader ports during each scan.

[0028] Referring now to FIG. 4B, process A starts with step 416. Following step 416, step 418 is executed and the first reader port is assigned a port number 1. Next, in step 420, the controller 24a,24b, etc. checks and determines the ID-type switch 23a,23b,etc. associated with this port number. In step 422, the ID data/symbol is read and is

appended to a port header 490 associated with reader port 1. In step 424, the ID data/symbol length is determined and appended to the port header 490. In step 426, the reader ID type is appended to the port header 490. In the final step 428, the port number is then appended to the port header 490 before process A ends in step 430. FIG. 4C illustrates the structure of the port header 490 generated at each reader port to which an ID reader 15 is connected.

[0029] The process of checking whether a reader port is connected is repeated until all N reader ports are checked. After the last reader port, i.e. reader port number N, is checked, for example in step 450, step 460 is executed and the port headers 490 from reader ports 1 to N are appended to form a total port header 490a. The length of the total port header 490a is then determined and then appended to a node header 492. Next, in step 470, the node number is appended to the node header 492 whilst, in step 480, a data packet 494 is assembled into a payload for transmission to the backend universal processor 20bes or indirectly by relaying through one or more adjacent universal ID processors 20a, 20b, etc. A data packet 494 comprises the total port header 490a and the node header 492.

[0030] FIGs. 4C and 4D show the structures of the port header 490 and node header 492, respectively. FIG. 4E shows the structure of the data packet 494. If a pictorial illustration of the results of the ID data coding process 400 is clearer, FIG. 4F illustrates a universal ID processor 20n1 (identified as node 1) and another universal ID processor 20n2 (identified as node 2). The exemplary data packets 494 transmitted between these universal ID processors are as shown with arrows showing the directions of transmissions of the relevant data packets, whilst FIG. 4G shows the port headers 490, node headers 492 and data packets 494 in a tabular manner.

[0031] After a data packet 494 is received by a universal ID processor 20bes at the backend station, the computer 28 at the backend station decodes the data packet 494 into individual ID data/symbols for verification, authentication and processing. FIGs. 5A and 5B show the decoding process 500. The decoding process 500 reverses the coding process 400, i.e. decodes the data packet 494 starting from the node number in

the node header 492, total port header length and so on until all information relating to the port numbers are decoded.

[0032] As shown in FIG. 5A, the decoding process 500 starts with step 505. In the following step 510, the computer 28 reads the node number from the node header 492. In step 515, the total port header length is read from the node header 492, whilst the port header data is read in step 520. In the following step 525, process B shown in FIG. 5B is executed in a loop until all the port header data, i.e. the total port header 490a, is decoded. Once all the port data in a data packet 494 is read in step 550, the decoding process 500 ends at step 560. The controller of the backend ID processor 20bes will then decode the next data packet from another universal ID processor 20a,20b, etc.

[0033] Referring now to FIG. 5B, process B starts with step 526. In the following step 528, the computer 28 reads the port number from the port header 490. In step 530, the ID type from the port header 490 is read. In step 532, the data symbol length from the port header 490 is read, whilst in step 534, the ID data/symbol from the port header 490 is read. In the following step 536, the ID data/symbol associated with each respective reader port 23a,23b,etc. is processed in the computer 28 and then the process B ends in step 538. The next port data is similarly decoded until the decision step 550 is positive. Once, all the ID data/symbol are read into the computer 28, the decoding process ends in step 560. With the present invention, all the ID data/symbol from each ID reader 15 are thus captured and coded by the respective controller 24a,24b, etc. in the form of a data packet 494 and transmitted to the backend ID processor 20bes, where all the ID data/symbol are decoded, verified, authenticated and processed.

[0034] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the invention. For example, whilst wireless transmission of the data packets has been described, it is possible that transmission of the data packets can be transmission via hard wires or optical cables.

AMENDED CLAIMS
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1. An ID data reading, transferring and processing system comprising:
a universal ID processor having a plurality of reader ports, wherein said one reader port is operable to be connected to an ID reader; and
a backend universal ID processor disposed at a backend station;
wherein:
said universal ID processor and said backend universal ID processor each has a controller and a wireless transceiver; and
ID data/symbol read by an ID reader is coded in a port header and a node header by said controller associated with said universal ID processor to form a data packet, so that said data packet is then operable to be transmitted by said wireless transceiver to said backend universal ID processor for processing.
2. An ID system according to claim 1, wherein the ID reader comprises a plurality of ID readers.
3. An ID system according to claim 2, wherein the plurality of ID readers comprises any one of the following types: radio-frequency ID, biometric ID, smart card, barcode and any new generation ID reader.
4. An ID system according to any one of claims 1-3, wherein the universal ID processor comprises two or more universal ID processors, so that transmission of a data packet is relayed to said backend universal ID processor through one or more universal ID processors.
5. An ID system according to any one claims 1-4, further comprising an ID-type switch disposed at each reader port to electronically distinguish the type of ID reader that is connectable to.
6. An ID system according to any one of claims 1-5, wherein the wireless transceiver is operable in an infrastructure-less or adhoc network linking said universal ID processor(s) and said backend universal ID processor.

7. A method for reading, coding and decoding ID data/symbol, said method comprising:
 - connecting an ID reader to a universal ID processor via a reader port;
 - coding the ID data/symbol captured by the ID reader into a port header and node header associated with the universal ID processor to form a data packet; and
 - transmitting said data packet to a backend universal ID processor disposed at a backend station for decoding and processing.
8. A method according to claim 7, wherein the universal ID processor has a plurality of reader ports and said connecting the ID reader comprises connecting each ID reader to each of said plurality of reader ports.
9. A method according to claim 7 or 8, wherein the ID reader comprises any one of the following types: radio-frequency ID, biometric ID, smart card, barcode and any new generation ID reader.
10. A method according to any one of claims 7-9, wherein said universal ID processor comprises two or more universal ID processors such that transmitting a data packet to the backend universal ID processor comprises relaying said data packet via one or more intermediate universal ID processors.
11. A method according to any one of claims 7-10, further comprises identifying an ID reader by setting an ID-type switch to a unique logical address.
12. A method according to claim 11, further comprises configuring a reader port to support an ID reader, setting the ID-type switch accordingly and upgrading the controller with a firmware for said ID reader.
13. A method according to any one of claims 7-12, wherein coding of the data packet comprises attaching sequentially the port headers from all ports connected with ID readers and the node header of the relevant universal ID processor.

14. A method according to any one of claims 7-13, wherein decoding of the data packet comprises reading a node number from the node header, a port header and so on in a reverse order from the coding process.
15. An ID data/symbol processor comprising:
a plurality of reader ports, each reader port being operable for connection with an ID data/symbol reader;
a controller in connection with the plurality of reader ports for assembling all the ID data/symbol read by the ID readers into a data packet; and
a transceiver for transmitting said data packet to a backend ID processor or relaying another data packet via an adjacent ID processor to the backend ID processor.
16. An ID data/symbol according to claim 15, further comprising an ID-type switch associated with each reader port, wherein a logical address of the ID-type switch is unique to the ID reader type that is connectable to the relevant reader port.