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[Continued on next page]

(54) Title: TRACEABILITY SYSTEM FOR BUFFALO MOZZARELLA, FROM SOURCE TO CONSUMPTION

(57) Abstract: The system is based on equipments and procedures appropriately instrumented by means of sensor RFID devices and software components distributed along the supply and sale chain, and configurable to support a set, beforehand open, of value-added services for end-users, to supplement traditional supply chains. In particular, the traceability system is outstandingly fit to the dairy industry, in particular to buffalo mozzarella.

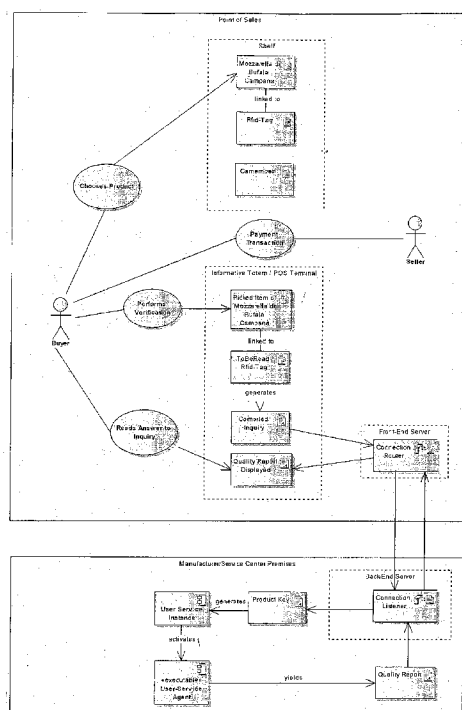


FIG.2



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Traceability system for buffalo mozzarella, from source to consumption.

Description

The purpose of the present invention is an integrated system that makes use of
5 computing and electronic devices, such as active tags (TAG) and workstations
with RFID, NFC or bar codes readers, and even laptop computers, connected to
one or more external centers acting as a controlling server and a management
system for tracing and ensuring the value of buffalo mozzarella, from source to
consumption.

10 As we know, products traceability has become an imperative need, especially in
the food products industry which associates the need to safeguard people's health,
strengthen the recognition of the intrinsic quality of the product and the producer
brand, to the need of optimizing the sourcing chain, storage and sale of products.

The aim of the present invention is to provide, through NFC and RFID
15 technologies, recognition and protection of the product value along the whole path
of the economic cycle that characterizes it, making traceable those interactions
steps, particularly to ensure the interaction of producers, wholesalers and
consumers with history and positioning of the buffalo mozzarella.

Another object of the present invention, in accordance with the preceding object,
20 is to provide an architecture based on an open and consolidated set of user and
system requirements, a "service-oriented" architecture.

Another object of the present invention, in accordance with the purposes above, is
to provide a reliable, complete and systematic traceability system, such that it
satisfies consumers expectations regarding food safety and quality of buffalo
25 mozzarella, makes available the documentation related to the history and origin of

products, facilitating their possible withdrawal and identifying the responsible organizations in the food chain, supporting claims by consumers, certifies compliance with regulations and policies of local, regional, national and international organizations, increases efficiency, productivity and profitability.

- 5 The purposes and advantages will be better understood and described by the following description of the production modes and the accompanying drawings, which include, but are not limited to.

Fig.1 shows the system as a whole and in its broad generality.

Fig.2 shows the system in its specific application to the dairy sector, in particular,

- 10 the buffalo mozzarella.

Fig. 3 shows in a block diagram the main requirements of the system concerning its implementation to the buffalo mozzarella.

Fig.4 shows a table which summarizes the main features of the system .

Fig. 5a and 5b show how to apply RFID tags to a milk container.

- 15 Fig. 6a, 6b and 6c show the access to traceability data of the product by phone.

As shown in Figure 1, the system is based on current equipments and procedures, appropriately instrumented by sensing devices and software components

distributed along the supply and sale chain, in particular, always referring to Fig.

1, it is labeled with "Attore1, n", the company/companies in the field of raw

- 20 materials (authorizations) or manufacturing (make) or transport (delivery) or

selling (sell) or services (service), including also instruments consisting of

machinery, equipments and tools (means of transport, containers, thermometers,

containers, counters, etc..) computers (RFID / barcode readers, PDAs, pocket PCs,

802.1x applications, namely access point (AP), totems acquisition and display,

- 25 etc..) & sensors (RFID), while it is labeled with "prodotto 1" the types of products

delivered by companies and made available in stores, which are tracked and whose quality (storage, organoleptic, nutritional, etc..) features are displayed to the consumer through a totem or simply using a mobile phone, connected to a Service Center based on a network infrastructure and a server computer that hosts a
5 database (service catalog) containing the service offer (sa, sb , sd) and a database containing a list of companies and consumers who benefit from the services themselves, the symbol (@) represents the infrastructure of global broadband interconnectivity, however implemented, whose backbone serves all actors and customers in the industry.

- 10 It is remarkable that the system architecture is not based on a closed and consolidated user and system requirements, but, on the contrary, it is easily adjustable to many commodity industries, including industries other than food. In addition, once the reference commodity industry has been established, the system can be set-up to support a set, beforehand open, of value-added services for
15 end-users, to supplement the traditional manufacturing sectors, in order to witness the intangible values of the product.

The implementation of the system object of the present invention relates to the dairy industry and in particular to the production chain of buffalo mozzarella in an architecture which aims to instrument every step of the manufacturing process and
20 of the product distribution, starting from the supply of raw materials to the distribution network of retailers, with the provision of services suitable for picking-up and highlighting tangible and intangible qualities accumulated throughout the product "history", that is objectively traceable throughout the whole extension chain of the product value itself.

The system architecture object of the present invention, in its initial form of implementation to the production chain of buffalo mozzarella will use different hardware and software distributed to different players in the industry.

The hardware parts of the farmer consist of his farm, with particular reference to the milking area and the steel milk tanks which it contains or are related to, that are interfaced to thermometers measuring the milk temperature. On the outer wall of the milk tank is placed an active RFID TAG support, that in turn is placed in a colored pocket, which is triggered by the farmer during the first milking. Upon activation, the TAG starts to operate as a data-logger for temperature retention. An additional element inserted in the environment is a beaconing access point that communicates with the active TAG and allows to identify the starting time of milk collection and detects the TAG movement when the milk tank is moving from the farm stable. The AP operates in the 2.4 GHZ band and supports fully 802.11b and 802.11g standards. Its data rate ranges from 2Mbit/s to 54Mbit/s and can work in different ways: as an access point, such as a point-to-point wireless bridge with another AP or as a point-to-multipoint wireless bridge, with a useful transmission distance between 100 meters indoor and 400 meters outdoor.

The hardware parts of the milk carrier to the processing cheese dairy consist mainly of the tank vehicle for milk transport or of the road/farm tractor of the towed milk tank which is associated to the active TAG used and applied to the milk container, which will continue the data logging of ambient temperature, and store the actual timestamp when it claims to have left the farm.

The hardware parts of the cheese dairy consist of a wireless network that allows tags, in the covered area, to send logging information to the central UDP server and receive any of these possible commands, a UDP server to acquire data from

the TAG and send action/setup commands to the servers above: a storage unit where there is a semantic database for storing information collected and annotated semantically, a server hosting the web-centric application for the use of traceability data through Web services and an agent-based for an ontological argument system to rate the ontological evaluation of the tracing process.

The hardware parts of the mozzarella carrier are made up primarily by a motor vehicle specific to transport with which it operates, by an active tag attached to the vehicle, by a handheld RFID/bar code reader and by a properly set-up WiFi equipment for POS-Access Point connectivity, and optionally also by an Internet connection running the GIAI server application for individual goods.

The POS hardware parts where goods are made available to consumers through the use of a user-service, information tracking system, which certifies the quality of the product that the end user is about to buy (a pack of buffalo mozzarella), consist of a counter for dairy products, the Information Totem and the computing workstation (Front-End Server) that will connect to the central system.

All those parts are connected to a service center (which can also be located at the headquarters of the reference dairy producer) where the central system running user-services is located.

The hardware parts of the Service Center include the Web-centric, remotely accessible system, MQTS, the wireless network carrying data by the active TAG: a CATALINA web server embedded in a JBOSS 4.2.3 GA application server which allows access to traceability information both from home, using a common web browser, or from the point of sale, or through wireless-enabled devices (smartphones, cell phones, etc.) which communicate with the server through the

wireless network made available by the point of sale, or by a totem equipped with RFID tag/barcode readers placed on the purchased product.

Product traceability throughout the entire production chain of buffalo mozzarella is as follows:

- 5 the Web Server receives continually the information on the activities from the early stages of milking and milk collection from the farmer and his pasteurization, chemical and microbiological analysis, as well as sourcing and transport orders containing information regarding the care of milk after leaving the dairy.

- Additional information are sent from the dairy during the production stages of
10 mozzarella until its packaging within secondary packaging that are loaded on the vehicle used to transport them from the dairy to the stores. They are associated through a hand-held RFID device to an active tag installed on the means of transport. The timestamp is recorded when it leaves the dairy

- The active RFID TAG is placed on the vehicle to alert its departure from the
15 wireless network of the dairy and records the timestamp when this happens.

At the time when the vehicle reaches the point of sale, the active RFID tag placed on the vehicle senses that it came within range of the wireless network of the point of sale, it records the connection timestamp to it, so as to allow the calculation of the duration of transport.

- 20 Then, the active RFID tag, by using the wireless network of the point of sale through the access point's MAC address to which it is associated, routes to the proper dairy Web server the information regarding the arrival of the vehicle at the geo-referenced location and all the data acquired by the active TAG on the vehicle during the road transport. If the point of sale does not have Internet access, the
25 TAG takes note of the time of arrival at the point of sale and stores it along with

the access point's MAC address to which it is associated to communicate it to the server once it returns home.

If the point of sale accepts the load, the secondary packaging is unloaded from the vehicle and identified by reading the labels from the carrier issuing the load, by an
5 enabled handheld device capable of reading RFID tags. If the point of sale has Internet connection, the handheld device sends data to the remote server, or store them and then download them once it returns home.

If the point of sale employee noticed problems with the load (broken secondary packaging, secondary packaging spilling out serum indicating the failure of a
10 primary packaging inside, inadequate loading ...), the load is rejected and the data which take charge of the rejected goods are properly sent to the web server of the dairy base.

When all the goods for the point of sale have been discharged, and the store employee has disassembled the secondary packaging, the primary packaging of
15 buffalo mozzarella are available in the counter for purchase by the consumer.

The end user goes to the point of sale, chooses the preferred mozzarella and prepares to make the purchase. The user can check at any time of the purchase (especially before he/she makes it) the information on product quality through:

A wireless network made available by the point of sale to allow user devices to
20 connect and control the quality of the product by entering the RFID or bar code of the product in the POS (Point of Service) terminal or through an information totem available in the point of sale and able to read RFID codes. And to retrieve information on bar codes related to the user.

In both cases, once the RFID code has been read and specified the requested type of service, a particular query is compiled (request) which is forwarded to the front-end server of the point of sale.

The front-end server of the point of sale is connected to the web server via the
5 central system that is always waiting for a request for user-service.

After connecting, the front-end server of the point of sale sends the query of interest to the central server, together with the read RFID code.

The query is taken over by an agent (program) of the central server which resolves it by referring to the company database and dynamically generating the report
10 containing the information on the product quality traceability.

This report is sent from the central server to the front-end web server of the point of sale.

At this point the buyer may view the contents of the quality report on his wireless device or POS terminal or information totem. The consumer can also disassemble
15 the primary packaging and check whether the product complies with the received information.

As we have seen, the system - beyond allowing the traceability at all production stages with great benefits -, allows to interface this traceability to the final consumer. In practice, when purchasing a product, a consumer can benefit at any
20 time from the possibility to trace product information he has just purchased. This is possible thanks to the presence of an in-store information point, or of a wireless network, through which the user can control the product's origin.

The activities that coordinate the retrieval of information on the product purchased by the user involves using a web browser through which it is possible to display

the Web page of the respective dairy and enter the product code printed on the primary packaging.

The dairy web server receives a request to pick-up the quality information by consumers and replies properly to the request by displaying the entire life cycle of

5 buffalo mozzarella.

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Claims:

1) A traceability system for buffalo mozzarella, from source to consumption, including the Web-centric, remotely accessible system, MQTS, the wireless network carrying data by the active TAGs: a CATALINA web server embedded in
5 a JBOSS 4.2.3 GA application server which allows access to traceability information both from home, using common web browsers, or from the point of sale, or through wireless-enabled devices (smartphones, cell phones, etc.) which communicate with the server through the wireless network made available by the point of sale, or by a totem equipped with RFID tag/barcode readers placed on the
10 purchased product and characterized in that:

a) on the outer wall of the milk tank is placed, within a support, an active RFID TAG, which in turn is placed in a colored pocket, which is activated by the farmer during the first milking and begins to operate as a data-logger of milk storage temperature, a beaconing access point communicates with the active TAG and
15 helps to identify the start time of milk collection and detect the TAG movement when the milk tank is moving from the stable of the farm;

b) in the dairy is installed: a wireless network, a UDP server to acquire data from the TAG and send action/setup commands to the servers above: a storage unit where there is a semantic database for storing information collected and annotated
20 semantically, a server hosting the web-centric application for the use of traceability data through Web services and an agent-based for an ontological argument system to rate the ontological evaluation of the tracing process.

c) the vehicle carrying mozzarellas has an active TAG, with a hand-held RFID/barcode reader and the equipment for Wi-Fi connectivity between the Access Point

and the Point of Sale, which is properly set-up, and optionally an Internet connection running the GIAI server application for individual goods;

d) in the point of sale there is an information totem and the computer workstation (Front-End Server) capable of reading RFID and bar codes, and of connecting to

5 the central system where traceability information which certify the quality of the product are made available to consumers;

e) after reading the RFID or bar code on the product, a query is compiled together with a RFID code that is sent to the RFID front-end server that connects to the point of sale via the web server to the central system which will resolve it by

10 referring to the company database and dynamically generating the report containing the information on the product quality traceability, and the buyer may display the contents of the quality report on his wireless device or POS terminal or information totem.

2) A traceability system for buffalo mozzarella, from source to consumption, as in
15 claim 1) characterized in that the product traceability is as follows:

The Web Server handles continually all the information on the activities, from the early stages of milking and milk collection at the breeder, as well as sourcing and transport orders with information regarding the care of milk when it leaves the dairy, additional information are sent from the dairy during the production of
20 mozzarella until its packaging within secondary packaging that is loaded on the vehicle used to transport it from the dairy to the points of sale, they are associated with a hand-held RFID and active tag installed on the active means of transport which detects the departure from the wireless network of the dairy and records the timestamp when this happens, when the vehicle reaches the point of sale, the
25 active RFID tag placed on the vehicle senses that it came within range of the

wireless network of the point of sale, it records the connecting timestamp to it, so as to allow the calculation of the duration of transport, so that the active RFID tag, leveraging the wireless network of the point of sale using the MAC address of the access point to which it is attached, routes to the Web server of the dairy the

5 proper information regarding the arrival of the vehicle at the geo-referenced location and all the data acquired by the active TAG on the vehicle during the road transport, if the point of sale does not have Internet access, the TAG takes note of the hour of arrival at the point of sales and stores it along with the access point's MAC address to which it is associated to communicate it to the server once it

10 returns home, and if the point of sale accepts the load, the secondary packaging is unloaded from the vehicle and identified by reading the labels from the carrier issuing the load with an enabled hand-held device to read RFID TAGs, and if the point of sale has an Internet connection on the hand-held device sends the data to the remote server, or stores them and then download them once back in office, if

15 the point of sale employee has noticed problems with the load, the load is rejected and the information to take charge of the rejected goods are properly sent to the web server of the dairy base, and when all goods for the point of sale have been discharged, and the point of sale employee has disassembled the secondary packaging, the primary packaging of buffalo mozzarella is available in the counter

20 for purchase by the consumer.

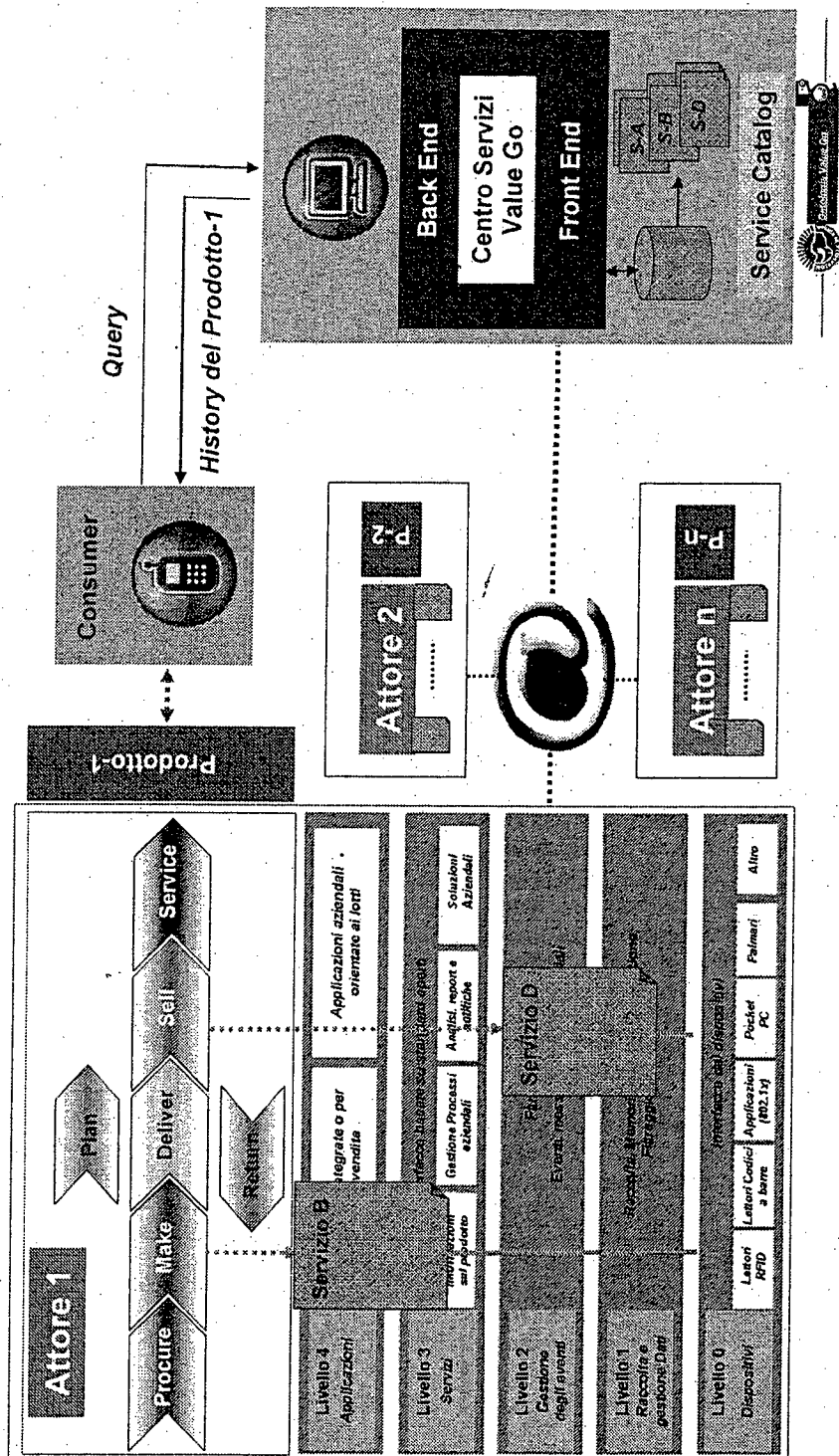


FIG. 1

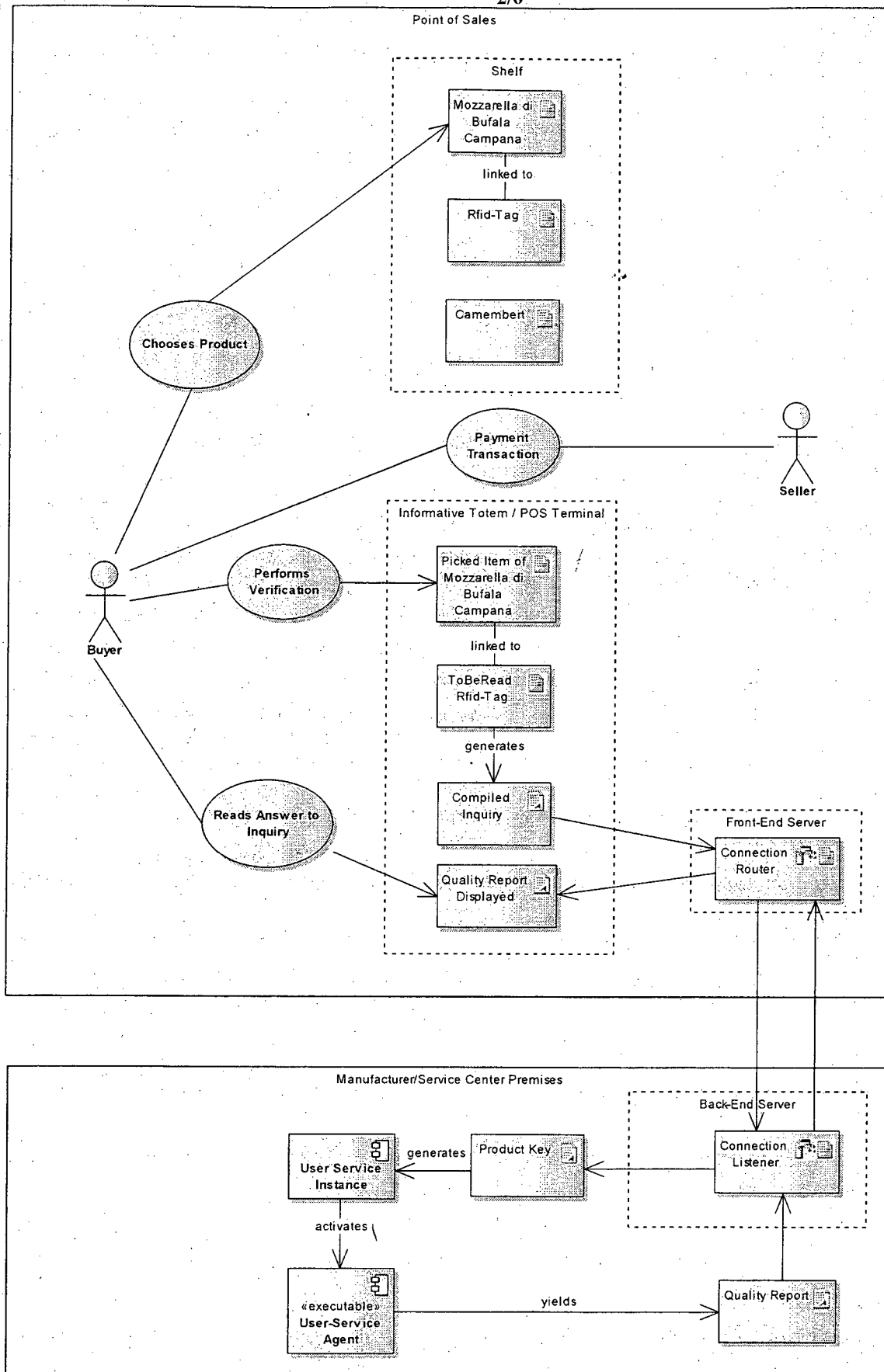


FIG.2

Source	Make	Delivery	Sell	Service
<ul style="list-style-type: none"> • Supply of raw materials and components • Checking and acceptance of raw materials and components, • Handling of warehouse locations for raw materials and components • Picking for production • Stock inventory 	<ul style="list-style-type: none"> • Management of containers and equipments for internal handling • Monitoring of progress in production • Storage of operating parameters and operating variables (temperature, speed, etc.). • Products traceability during processing 	<ul style="list-style-type: none"> • Control and acceptance of finished products • Storage • Picking • Arrangement of orders • Cargo transport • Inventory management • Inventory 	<ul style="list-style-type: none"> • Logistics activities at the point of sale (receipt, storage, etc.). • Shelf supply • Store supply • Offers and promotions management 	<ul style="list-style-type: none"> • Returns management • Handling of complaints • After Sales Support • "Unplanned" order management • Campaign Management
<ul style="list-style-type: none"> • Inbound logistics efficiency (reduced time) • Reduced errors in goods receipt • Reliability and optimization of the availability of stock • Support for quality control acceptance • Optimizing the orders management to suppliers of raw materials 	<ul style="list-style-type: none"> • WIP Control (Work In Progress) • Reduced errors in some operations in production • Determination of product cost • Configurable tracking Vs the Production Cycle • Integrated information system adhering to production reality 	<ul style="list-style-type: none"> • Reliable availability of stock • Reduced risk of products obsolescence or decay • Increased rolling stock • Reduced shipping errors • Reduced picking times • Tracking logistic operations • Accurate order management 	<ul style="list-style-type: none"> • Reliability of store stock availability • Reduced risk of products obsolescence or decay • Best level of service to end users (consumers) • Higher revenues for a better space management • Reduced time for logistics • Reduced losses because of counterfeiting, parallel markets, theft 	<ul style="list-style-type: none"> • Best level of service to the customer (retailer) • Decrease in complaints • Increased effectiveness in managing just-in-time • Intelligence support to customers (retailers) • Opportunistic sales possibilities (lots expiring, on-line offers, etc.).

FIG. 3

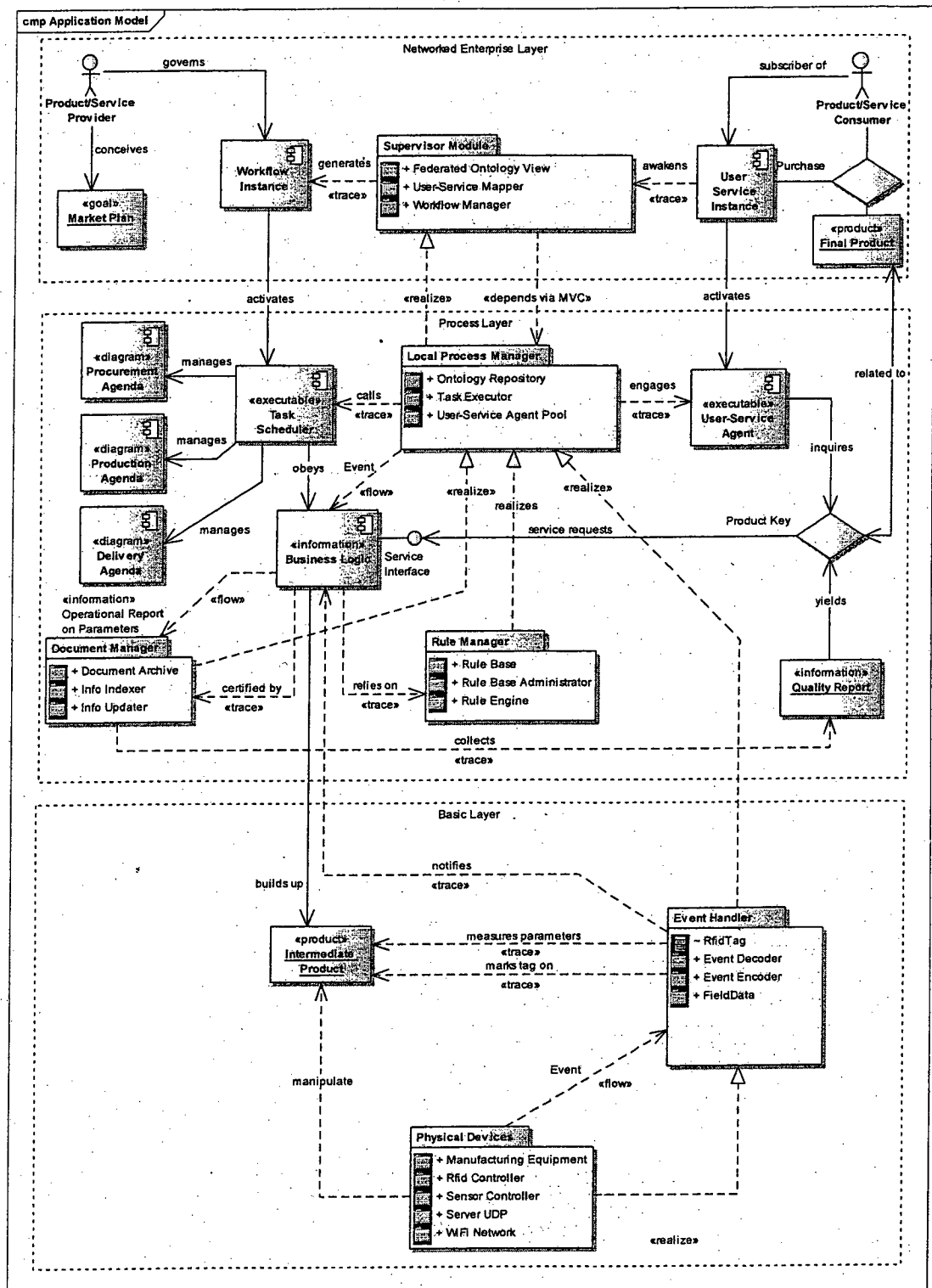


FIG.4

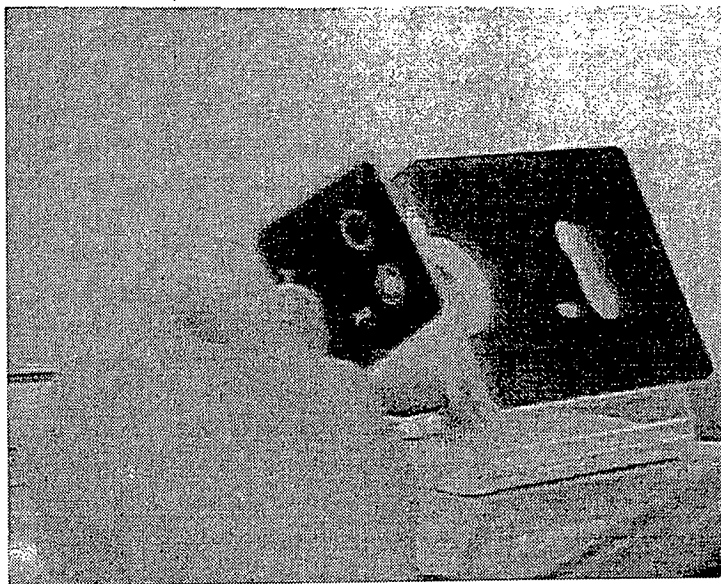


FIG. 5a



FIG. 5b



FIG. 6a

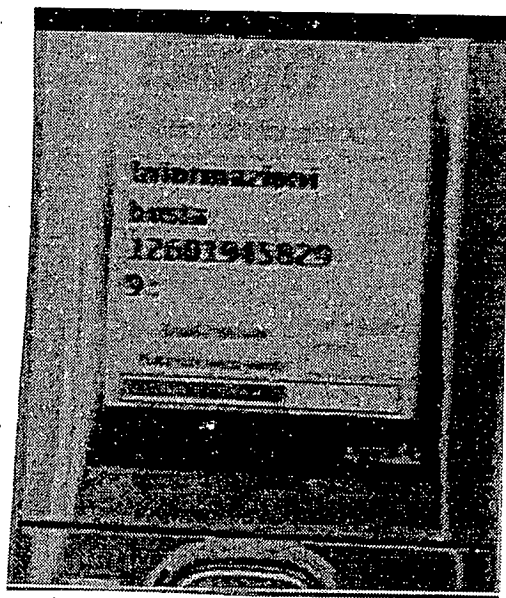


FIG. 6b

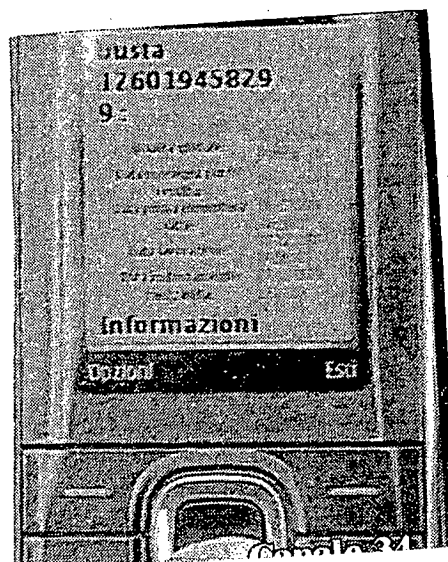


FIG. 6c

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2011/000021

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06K17/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/143860 A1 (CATAN CAROLYN RAMSEY [US]) 3 October 2002 (2002-10-03) paragraphs [0006] - [0008], [0012], [0059], [0090] -----	1,2
X	US 2008/143532 A1 (MURRAH JUDITH [US]) 19 June 2008 (2008-06-19) paragraphs [0028] - [0038], [0070] - [0082] ----- -/--	1,2



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

8 April 2011

Date of mailing of the international search report

19/04/2011

Name and mailing address of the ISA/

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Authorized officer

Koegler, Lutz

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2011/000021

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>YELIZ EKINCI ET AL: "The Application of UHF Passive RFID Technology for the Effectiveness of Retail/Consumer Goods Supply Chain Management", RFID EURASIA, 2007 1ST ANNUAL, IEEE, PI, 1 September 2007 (2007-09-01), pages 1-6, XP031153298, ISBN: 978-975-01-5660-1 the whole document</p> <p>-----</p>	1,2
X	<p>US 2004/155106 A1 (SCHMIDTBERG RUPERT A [US] ET AL) 12 August 2004 (2004-08-12) paragraphs [0003] - [0008], [0018] - [0028]; figures 1-2</p> <p>-----</p>	1,2
X	<p>HENNING BAARS ET AL: "Combining RFID Technology and Business Intelligence for Supply Chain Optimization Scenarios for Retail Logistics", HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES, PROCEEDINGS OF THE 41ST ANNUAL, IEEE, PISCATAWAY, NJ, USA, 1 January 2008 (2008-01-01), page 73, XP031207941, ISBN: 978-0-7695-3075-8 the whole document</p> <p>-----</p>	1,2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IT2011/000021

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