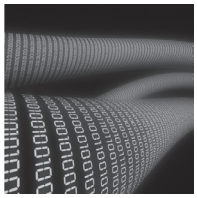

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Use of RFID as a supporting information pillar in oversized transport

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ABSTRACT

There are nowadays more intelligent information systems in transport, and the RFID technology (radio frequency identification) is increasingly expanding, particularly for its versatility and ability to use without the need for constant renewal of the technical base (no need for regular investment, only for this technology use). Following the oversized transport used for the automotive industry, this technology plays major role in information system between producer / production plants and suppliers. In the event that the producer uses the RFID technology for automated recognition and reception of goods, an RFID chip needs to be attached to each pallet. The data on the chip contain exact data about specification of panels on the pallet as well as the quantity of panels on the pallet and the order of panels. The information contained on the RFID chip ensures factories a reduction of time for checking the goods in terms of goods type of and their frequencies. The RFID technology is a critical transportation technology capable of providing carriers the required information in real time and is also affordable. The link between software and RFID technology – the GPS system is an important aspect, because it is possible to attach additional information to the goods directly via the GPS system. In our contribution we describe the possibilities of that technology.

KEYWORDS: GPS, RFID, oversized transport

1. Introduction

Radio Frequency Identification (RFID) systems are a common and useful tool in manufacturing, supply chain management, and inventory control. Industries as varied as microchip fabrication, automobile manufacturing, and even cattle herding have deployed RFID systems for automatic object identification. For over twenty years, consumer items have been identified with optical barcodes. One familiar optical barcode is the Universal Product Code (UPC), designed in 1973 and found on many consumer products [2]. More recently, RFID has made inroads into the consumer object identification market. Silicon manufacturing advancements are making low-cost RFID, or "smart label", systems an economical replacement for optical barcode. RFID systems consist of radio frequency (RF) tags, or transponders, and RF tag readers, or transceivers. Tag readers interrogate tags for their contents by broadcasting an RF signal. Tags respond by transmitting back resident data, typically including a unique serial number. RFID tags have several major advantages over optical barcode systems. Tag data may be read automatically: without line of sight, through no conducting materials such as paper or cardboard, at a rate of several hundred tags per second, and from a range of several meters. Since tags typically are a silicon-based microchip, functionality beyond simple identification may be incorporated into the design. This functionality might range from integrated sensors, to read/write storage, to supporting encryption and access control.

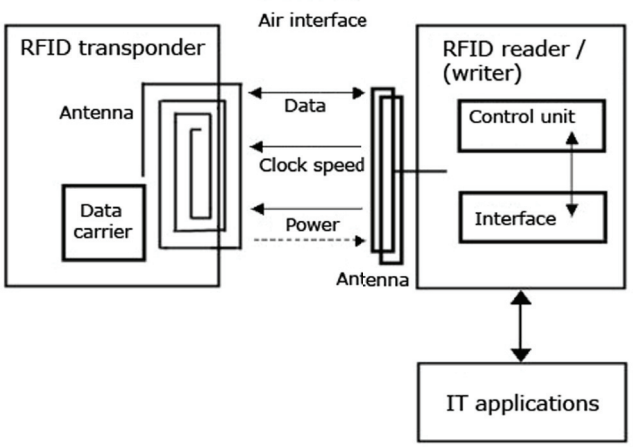

Fig. 1. Schematic representation of RFID technology [6]

This technology represents the foundation of the information system between a producer/ production plant and a supplier in connection to the oversized transport used in an automotive industry. In the case that a production plant uses RFID technology for recognizing and automatic acceptance of goods it is necessary that every palette is labeled precisely by the RFID chip and data which is stored on the chip would specify exactly the type of part on the palette, quantity of parts on the palette as well as exact order of particular parts on the palette. Specific information written on the RFID chip will provide a reduction of checking time for accepted goods from the viewpoint of the type of goods and its amount (see Figure 2).

In the case there is a missing part on the palette while RFID chip contains the information about the missing part (a mistake of automated line on the supplier side or a mistake in data from a producer), the goods will be accepted, however in the moment of palette entrance with incorrectly loaded parts into automated inventory, the system will report the mistake. As a next step, the missing part has to be adding on the palette, so the production process can continue.

RFID chip plays very important role in the oversized transport because we can also record additional information about location of a specific palette in the space of a semitrailer (vertical and horizontal positioning because palettes are aligned into two and more floors within the oversized transport). The advantage of this information is the opportunity for giving preference to unloading of a specific type of parts which are urgently in the production process in that time [3].

Fig. 2. RFID chip made by BALLUFF firm

2. The process of loading and transport of palettes labeled by IRFD chip within the oversized transport

The foundation of the whole process is data from an automotive producer about the fact what parts are needed for inventory, so the production can run. The data is sent to suppliers most often 24 hours, possibly 48 hours in advance (however, with some producers, it is possible to prepare data for suppliers 1 week in advance which depends on the status of orders from customers). After receiving of the data from an automotive producer, a supplier process the data and send it to a special transfer automated link (a sequence link).

This fully automated link will provide loading of palettes in required time and with exactly designated parts according to given data from an automotive producer. After loading, a palette will be marked with RFID which is always present on each palette.

Fig. 3. An automated loading of palettes

Subsequently, additional information about location of a palette in a semitrailer's space will be recorded as well as information of truck's registration number in which the palette is transported (data writing is possible by specialized recording device).

The palette which is thus prepared is loaded at ahead determined place (vertical as well as horizontal location), so it could fit exactly the written data in the chip. Parts are transported to the place of unloading at an automotive producer (I stress that in a fully automated inventory of the producer the unloading position is determined ahead for every truck. This has to be always kept by the carrier). The information gained by this way has a significant meaning for a carrier from the point of view of actual situation with loading, transport and unloading. At the same time, the carrier gains a final information about finishing of the whole process of transport because the entrance of the prepared palette with an RFID chip in that way into fully automated link in a production plant is the moment when the palette is recognized as

accepted and the responsibility for goods passes automatically on the producer/production plant.

All this additional information which means the improvement of the system for goods controlling in the oversized transport increases the efficiency, the ability of action and in the urgent situations this transport system enriched by the additional information is able to manage much more stress caused by external influences which occur very often in the process of transport.

Fig. 4. Unloading process for oversized goods

3. Modification of information on RFID chip and positioning of the chip on the palette with taking the oversized transport into account (loading into two floors)

RFID chips are often attached to palettes in the FIX case which is always positioned on a palette (the case is always positioned on the palette at the same place, so 100% legibility of information is provided during the process of scanning at the moment of entering into an automated link at the automotive producer.

First method is represented by the 'FIX' chip which is positioned on a palette while data on this kind of chip is not modified and stays unchanged (the chip contains the information about a type tagging part on the palette and quality of parts on the palette). At the same time, we are dealing with JIT transport (just in time). Thus the palette marked by the chip is automatically loaded in a sequence link always with the same parts with the same quality. Reduction of handling time for data recording on the chip is the advantage as well as reduction of mechanical wearing away of the chip which means increase of its lifespan (an estimated cost for one RFID chip displayed below is 20 Euros up to 40 Euros).

Second method 'FIX+' is derived from the first method, however it differs in the way that data on the chip is overwritten with new data during every loading of a palette in the sequence link because all parts for FIX+ are exclusively sequence and thus the order as well as the type of parts and possibly the quantity can be freely modified according to requirements of the car producer (at the same time we are dealing with JIS transport which means 'just in sequence').

Method FIX or FIX+ does not play significant meaning in connection to the type of transport and thus it does not matter whether it is standard transport or oversized transport because additional information about positioning of a palette in the semitrailer's space can be possibly added on the chip using the method FIX as well as FIX+. The lifespan of a chip within the method FIX+ can play the essential difference because in this case RFID chip is constantly taken out, inserted and scratched and thus mechanically damaged.

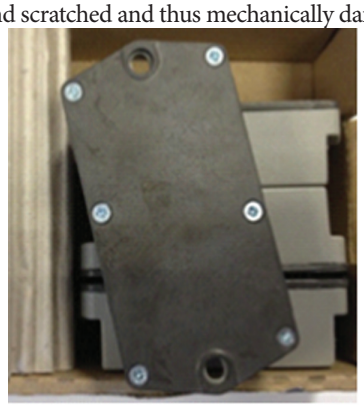

Fig. 5. The back side of RFID chips

Fig. 6. The FIX case for positioning of IRFD chip

4. Method of data writing on the RFID chip and writing in additional information

Data on the RFID is written manually by using the chip data writing device (the data writing into data recording programme is manual) or in an automated way when the recording device is put on the chip and the data is automatically recorded from the system (no manual writing is needed because the data is automatically processed and ready for entry). Thus the chip with recorded information is also checked. Nowadays, manual data writing is being left and the automatic data writing method is promoted more and more.

The automatic data writing takes a few second after it is started by a person who is responsible for data writing on the chip. The person is also responsible for checking of written data and conducting random checking, so mistaken data writing can be avoided and thus avoiding refusal of loaded palette into an automated system of the car producer. The data congruence is the first step in the process of the accepting the palette into an automated system of the car producer.

Fig. 7. An inserted palette into automated system of the car producer

6. Conclusion

The field of activity which RFID technologies offer is growing not only in retail, service and industry but also in public procurement, production and distribution logistics. The technologies provide higher efficiency in monitoring and managing of supplier's chains whether in reducing of supplies, optimizing of processes Just-in-time, monitoring of deliveries or in monitoring of mechanical or weather influences on goods during transport. Influence of oversized transport and needed information for such method of transport are getting bigger and bigger significance. Information about goods which is being loaded, transported or unloaded is very important for a carrier not only from the viewpoint of supplying process for a car producer but also from the viewpoint of attractiveness for purchaser (current information mainly about location of goods and its positioning in semitrailer's space has a great significance). Every purchaser welcomes the opportunity for on-line monitoring and thus better and more precise planning for future production or prompt reaction in the case of unexpected events. RFID technology is from the viewpoint of transport the technology which is able to provide required information for a carrier in real time and has a convenient price. Software connection between RFID technology and GPS system is very important aspect because most carriers have GPS system already installed directly in traffic vehicles and because of this fact it is possible to send additional information about goods directly into GPS system. In near future, GPS systems for vehicle monitoring will be at the same time systems which will be able to support RFID technology in such specific supply environment as JIT supplying is and for example in JIS system, it will be also possible for oversized transport.

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