Acta Tecnología – International Scientific Journal about Technologies
Volume: 1 2015 Issue: 1 Pages: 9-12 ISSN 2453-675X

AUTOMATION MONITORING OF RAILWAY TRANSIT BY USING RFID TECHNOLOGY

Michal Balog
Technical university of Kosice, Faculty of manufacturing Technologies with a seat in Presov, Department of management manufacturing.. Contact: Bayerova 1,080 01 Presov, e-mail, michal.balog@tuke.sk
Jozef Husár
Technical university of Kosice, Faculty of manufacturing Technologies with a seat in Presov, Department of management manufacturing.. Contact: Bayerova 1,080 01 Presov, e-mail, jozef.husar@tuke.sk
Lucia Knapčíková
Technical university of Kosice, Faculty of manufacturing Technologies with a seat in Presov, Department of management manufacturing.. Contact: Bayerova 1,080 01 Presov, e-mail, lucia.knapcikova@tuke.sk
Zuzana Šoltysová
Technical university of Kosice, Faculty of manufacturing Technologies with a seat in Presov, Department of management manufacturing.. Contact: Bayerova 1,080 01 Presov, e-mail, zuzana.soltysova@tuke.sk

Keywords: automatisation, RFID, railway transport, electronic waybill
Abstract: Aim of thispaperispresentedthepossibility of using RFID technology by railway transport monitoring. First part of thearticledescribes a comprehensivesystemfortheapplication of RFID technology in theenvironment of Slovak railways. Second part of thepaperdescribestheprinciple of informationsystem and design of theelectronicway-bill. The big problem is related to railway transit, where problem is in the transferring many information, e.g. waybill, technical condition of the wagon, date of the maintenance and repairs, etc. So, there is a possibility of using RFID technology. If we want to introduce RFID technology, it is necessary to create the entire concept of automatic data collection;
this can determine the tracking location of wagons and collecting information about the car.

Introduction

In today's, it is obvious to focus on the automatisation. The big problem is related to railway transit, where problem is in the transferring many information, e.g. waybill, technical condition of the wagon, date of the maintenance and repairs, etc. So, there is a possibility of using RFID technology. If we want to introduce RFID technology, it is necessary to create the entire concept of automatic data collection; this can determine the tracking location of wagons and collecting information about the car.

1 System location of the RFID technology in the railway transport

The introduction of RFID technologies in railway transport specifies the regulations and standards relating to rules and how you can apply this technology in compliance with certain standards. RFID tags located on the wagon have to in accord of ISO rules during its positioning to avoid unread information on the porter. It is necessary to take care on position of application reading device which must be able to read the information stored on the tag and at a higher speed [1], [2].

The required speed is adapted to frequency band, or i tis possible to locate the brand of speed reduction on the line and due to reader was able to read the RFID tags on the car or on the transport unit. When RFID tags are positioning on the wagon in the railway transport, it is known that the location of passive RFID tags (see Fig. 1) on the sides of the wagons is such that the reader can read the identification number of the wagon [2], [4], [6]:

- A1 minimum height of the RFID tag center is 500 mm,
- A2 maximum height of the RFID tag center is 1100 mm.

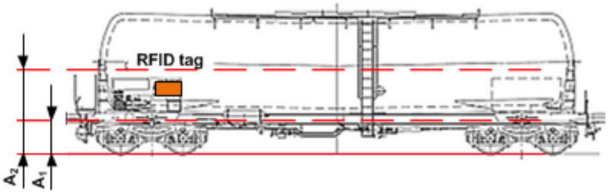

Figure 1 The possible way of height placement of RFID tags

Graphical interpretation on the Fig.2 shows suitable location of RFID tag in real conditions according to railway cargo transport [5], [7]. Location of RFID tag meets all of the standards under directive number 861/2006.

AUTOMATION MONITORING OF RAILWAY TRANSIT BY USING RFID TECHNOLOGY

Michal Balog; Jozef Husár; Lucia Knapčíková; Zuzana Šoltysová

Figure 2 Aplication of RFID tag in real conditions of railway cargo transport

RFID reader located near the railway, must be placed (Fig.3) at a distance in order to read the identification number of the wagon , which is located inside the RFID tag:

- D1 minimum length distance of RFID reader is 1000 mm,
- D2 maximum length distance of RFID reader is 10 000 mm,
- Maximum travel speed of trainset is 30 km / h.

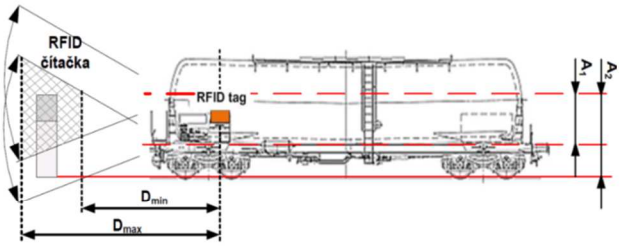

Figure 3 Way of linear placement of RFID readers

RFID reader construction must be resistant to weather and climate conditions. Changes in climatic conditions (wind , humidity, sunshine, snow) can damage the RFID reader , therefore it is necessary to think about when installing on all aspects that may damage the functioning of the system. Construction of stationary reading device is mounted on a solid concrete foundation to be extremely resistant to climatic conditions and also against theft. Connections (communication) between RFID tags, reader and a computer unit that contains the appropriate program for the processing and evaluation of the received information, they must communicate seamlessly together [7], [9].

Transmission can be performed with the help of optical cable line that railways are already using, or using wireless transmission, which is also commonly used. Optical cables are laid in the ground and have a higher capacity to digital broadcasting, which is several times faster and have better quality than an analog signal.

Vibrations or weather conditions affect wireless transmission, but eliminating adverse effects is possible by using the antenna and the amplifier device that is able to improve and enhance a number of times transmission of the signal [2], [8], [9].

Positioning system tracking of wagons is now positioning system tracking of wagons built on the basis of simple software application (information system operation - ISO) that, based on interaction with humans eventually ensure the data collection. Information concerning the wagon train set are identified by competent worker, who this information undergoes to the next worker for subsequent computerization of the data collected in a central data base. This identification process of all cars is carried out only in the starting and final destination for review. From this perspective at present, it is not possible to say exactly the position monitoring system of wagons in railway cargo transport. With more complex process it is possible to work towards the current position of the trainset . On the other hand, the current position of individual wagons, does not record stolen wagon or trainsets during transport. The most important part in terms of tracking wagon position in railway cargo transport is necessary to meet the basic functionality of the RFID system.

In order to meet the RFID system architecture , this concept (Fig.4) consists of the design of hardware and software components , which operate on the interaction principle. The hardware equipment and all part of the system in more detail are described in the following sections. The software product is in this case understood as a computational device as a server with a database.

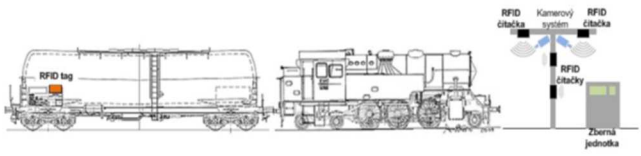

Figure 4 System of wagon tracking position

The way of wagon position tracking is carrying out continuous running through the trainset via a reading device, thereby activating the radio communication module [9], [10].

Transfer of data from RFID tags placed on wagons is provided by stationary reader. It is executed in parallel video recording, which is transferred to the collection unit positions near the track, together with obtaining wagon data by opto - electrical connection. The accumulated information can be periodically sent to the nearest station that will use this information for tracking the wagon position. The local station conveys the information thus obtained regional offices , which sent the obtained

information to a central hub in the east, central and western Slovakia. The process largely automates the transmission of information, but is conditional upon the reader, which has to be installed in every station on entry and exit, not only on the starting and final station.

2 The proposal of implementing RFID into the information system

In the present state, workstation of cargo treasury comprises a number of workers who have the task of receiving individual waybills. Mainly there are waybills for domestic traffic , international transport designated as CIM or for international railway transport to the East SMGS. The worker has access to a computer with a installed Windows XP operating system and the appropriate browser (Internet Explorer) to trigger the necessary information system [3], [8].

Each worker has access only to the individual items he need for the registration of his requirements pertaining to that waybill. After receipt of the waybill in the national transport, worker handles different parts of the waybill, which contain data e.g .:

- customer data (name, address, registration number),
- sending station,
- date, required time of wagon attending,
- goods (type and weight)
- wagon (number, series or alternate series)
- station and destination railway or border crossing stations
- the requirement to borrow canvas (or amount),
- customer confirmation.

All these data and other data from waybill are manually entered into the information system ISP into the traffic order application. Worker lists all further necessary data and codes that are in boxes of various applications such as processing shipments, treasury and transport restrictions. Detailed description of these applications and the necessary data can be found in the previous chapters [4].

After these steps, the specifics entered in the ISP are transferred to the information system SAP R3. Subsequently, the original waybill is leaves to recipient at the arrival station, duplicate invoice is sent to Discontinue sales of railways (DSR), and duplicate gets in the sender departure station. After operation, collecting and processing individual waybills, accounting waybills are transferred from Centre of cargo transport in the form of a truck to discontinue railway sales at the station of Railway Company. According to high level of development of information, communication technology and level of automation in enterprises, it would be benefit to use electronic waybill transferred to RFID tags.

Electronic waybill replaces fully or partly its paper form in the national, international respectively SMGS transport. A customer who orders the transportation (sender) will might enter all the necessary data on shipments in the electronic waybill and subsequently with the help of EDI (Electronic Data Interchange) sent information to the railway system in the comfort from his own computer at own company. Transportation order will be created in the information system for specific customer and worker fills in all other particulars. Electronic waybill is entered into a database and worker processes price offer. Feedback to the sender will be in the form of price offer acceptance and on that basis shipper confirms or rejects the start of the transportation. Another alternative would be easier for a customer it will be registration of the company in the database of the information system of the railways.[6,8] Customers, who are registered in the online system of transport order, they will be entered only minimum amount of data:

- End time of transport
- Product name
- Type of transport
- Quantity of goods

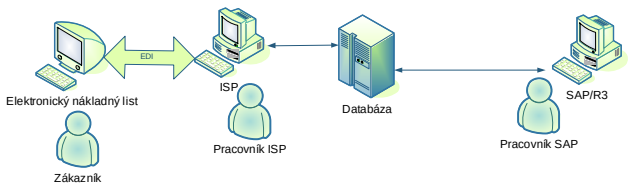

Figure 5 Using the electronic waybill

This order will be registered by using EDI into the order database of the customer. The customer should have access to their own orders, to repair or change data. This database would further exploit the SAP / R3 for accounting purposes. Worker should be assigned after receipt of the order to the transportation quote and sent it to customer and then the customer would confirm or cancel the given order shipment [3], [7].

Benefits of implementing an electronic waybill and EDI:

- reduction mistakenly entered data,
- speeding up the processing of documents,
- acceleration of documents delivery
- shortening the time when complaint procedure,
- removing the need for physical storage,
- removal of intensive search in the archives,
- automation of accounting with the correct settings for the processing of electronic documents would be automatically recorded,
- clarifying the whole process,
- facilitate and speed control,
- acceleration of customer communications – railway,

- improving customer service,
- accelerating the whole process of transport.

Savings in the implementation of electronic waybills and EDI:

- reduced operating costs for printing documents,
- save money on mailings,
- saving work of employees,
- cost savings for the operation of the archive and archiving,
- savings on office supplies,
- labor saving,
- saving labor costs [1], [2].

Based on the principle of introducing RFID systems in rail traffic, the electronic waybill will be written using Middleware for RFID tags. It would contain all the necessary information for the client side and the receiver side. It would also be possible to check the position of railway wagons and provide this information to the client in the information system at any time.

Conclusions

This paper describes the main principles for the installation of RFID technology into the railway background.

The first part of this article presents summary requirements for installation tags and antennas according to the legislation in force in Slovakia. Article also describes a complex system involving tag - antenna - middleware - computer. The second section describes the principle of operation of an information system and design of electrical waybill. Article offers perspectives of application of RFID technology.

References

[1] PARET, D.: RFID at Ultra and Super HighFrequencies, Theory and application. John Willey , United Kingdom, 2005
[2] YALCIN, S. B. O. RadioFrequencyIdentification: Security and PrivacyIssues. Springer-VerlagBerlinHeidelberg, 2010
[3] BLECKER Thorsten: RFID in Operations and SupplyChain Management: Research and Applications, Erich Schmidt VerlagGmbH&Co KG, (2008)
[4] DOBKIN Daniel M.: The RF in RFID: UHF RFID in Practice, Newmes, 540 str., 2012
[5] IŽOLOVÁ, Jana: Aplikácia RFID kódov v logistike. Dizertačná práca, TUKE, 2011
[6] JURČO Ivan: Kompatibilita informačných systémov v železničnej doprave na Slovensku, Diplomová práca, TUKE (2013)
[7] Štatistické materiály Železničnej spoločnosti Cargo Slovakia, a. s. Výročná správy za rok 2014. Štatistická ročenka 2014, Dostupné na internete: http://www.zscargo.sk/
[8] Komplexný podnikový ekonomický informačný systém, Available online: http://www.zsr.sk/slovensky/o-nas/organizacne-utvary/zeleznicne-telekomunikacie/produkty-a-sluzby/sap-r-3.html?page_id=670
[9] ISI, Available online: http://www.topu.mil.sk/data/att/15521_subor.pdf
[10] Informačné systémy, Available online:http://hornad.fei.tuke.sk/~genci/Vyucba/SRBDp/2003-2004/03-FyzickaOrganizacia/CekanFurman/zdroje/IS_K11.pdf

Review process
Single-blind peer reviewed process by two reviewers.