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APPLICATION OF RFID TECHNOLOGY FOR INCREASING OF EFFICIENCY AND SAFETY IN RAILWAY TRANSPORT

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ABSTRACT: This article is focused on application of RFID technology in real conditions. On the basis of increasing interest in radio frequency identification and related to numerous applications for increasing of automation in information systems, it is the field of application interest the railway transport. The reason of RFID technology application is not only effort for increasing of efficiency but also increasing of safety in railway transport. This article discusses the innovative solution in the field of railway transport the application of which it is a prerequisite to the increase in efficiency, as well as the overall safety of railway transport. The solution consists in positioning of RFID tags to road signing in railway transport with a view to obtaining information on individual sections of the railway communication.
Keywords: information system, RFID technology, railway transport

1. INTRODUCTION

Technological development, automation and awareness are efficient tool for managing of manufacturing and non-manufacturing plants. The using of suitable technology provides for plants the increase in efficiency of processes, which have influence on organization management. [1][2] At the present the latest trends is loading the radio frequency technology into the various industrial branches. [5]

2. RFID TECHNOLOGY

Principle of radio frequency identification is based on using of wireless non-contact radio frequency electromagnetic fields of data transmission for the purpose of automatic identification and observation of RFID tags which are situated in objects. [7]

RFID tags contain electronically stored information, which is received on initiative of RFID readers and aerials from the tag. The tag is not necessarily directly visible to the reader and it may be embedded in the monitored object unlike bar code.

The basic components of an RFID system include [9]:

- Transponder so called RFID tag – it is constituted by chip (electronic memory circuit), aerials and own energy source – battery (in the case of active or semi-passive tags). All of parts are situated on a properly designed supporting sheet of plastic or paper,
- Reading device so called RFID reader – it is constituted by transmission circuit, receiving circuit with decoder and aerial. In some cases it can be equipped with a sensor and its own operating system (software) with basic functionality.
- Middleware – it is constituted by supporting systems (control computer, database and telecommunication network).

RFID systems differ in numerous aspects: working frequency and reading distance, type and capacity of tag memory, target and insurance of data. [6]

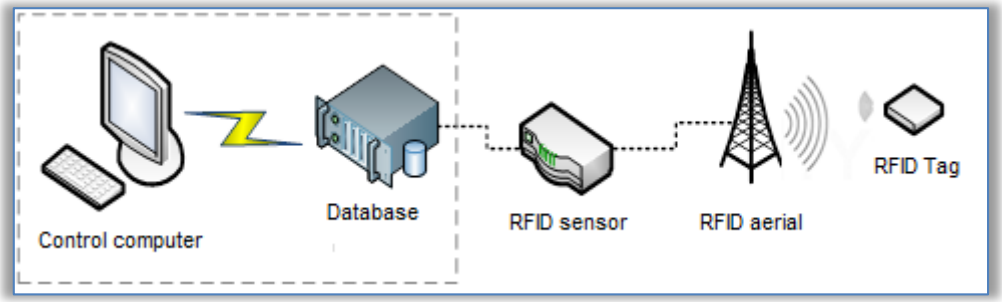

Figure 1. Conception of RFID Technology

3. CLASSIFICATION OF RFID SYSTEM BY TYPE OF SUPPLY AND FREQUENCY BAND

Passive RFID tag not includes own energy source and it is dependent on the power supply of the aerial sensor. The sensor spreads electromagnetic field by aerial. The electromagnetic field serves as the energy source for RFID tag and as communication channel in the line of sensor to RFDI tag. Primary purpose of passive tag setting is identification of objects at which the transfer of pluses is realised directly in tag. [6]

Active RFID tag not serves only for identification of objects but also for further functions as temperature measurement, pressure measurement etc. Active RFID tag can be independent on sensor and it can contain the sensors for measurement of physical quantities. Often, it is able to visually and acoustically to communicate with user. It means that it receives and emits data at the same time. The communication comparison of passive and active RFID system is presented in Figure 2. [6]

a) b)

Figure 2. Communication comparison of a) passive RFID system with pulse transfer to answer and b) active RFID system with modulated data

Table 1. Frequency bands of RFID systems [4]

Frequency band	Frequency range	The most common using frequencies in RFID system
Low frequency (LF)	100 kHz – 500 kHz	125 kHz, 134.2 kHz
High frequency (HF)	10 MHz – 15 MHz	13.56 MHz
Ultra high frequency (UHF)	400 MHz – 950 MHz	866 MHz – Europe; 915 MHz - USA
Microwaves (μW)	2.4 GHz – 6.8 GHz	2.45 GHz, 3.0 GHz

Table 2. Components of RFID systems with their parameters and units [4]

Part of system	Parameter	Unit
Complete system	Working frequency	MHz
	Range	m
	Transmitted power	W
Reading device	Receiver sensitivity	dBm
	Dynamical range of receiver	dB
	Tag´s number – recorded at the same time	s^{-1}
	Impedance	Ω
Aerial	Gain	dBi
	Polarization	Type of polarization
	Chip sensitivity	dBm
	Polarization	Type of polarization
Tag	Aerial aperture	cm^2
	Input impedance of aerial (measured)	Ω
	Conversion loss of Tag-s	dB

Secondly, the choice of suitable frequency (Table 1) for concrete application is one of the most important phases of RFID system solution proposal. For this option, it follows the numerous of other restrictions, such as:

- the impact of reading,
- writing and reading speed,
- usability in various settings and etc. [4]

Final qualitative characteristics are dependent on following technical parameters of particular parts of RFID system. [6]

4. APPLICATION OF RFID TAGS ON ROAD SIGNING IN RAILWAY TRANSPORT

Currently, there are many concepts of similar systems particularly in application in read transport. Most of them use the inbuilt camera inside of vehicle with on-board computer. This computer processes visual impulses and it points out a driver about the current situation by chosen method. [3][8]

Systems based on camcorder principle are dependent on weather conditions and daylight. Rain, fog and deficient lighting impossible correct interpretation in these systems. This article describes the principle of RFID tags placing on road signs in rail transport.

General conception of this system consists in RFID tags placing on road signs and in application of RFID reader and aerial on suitable place in carriage. RFID reader and aerial provide receiving of information for middleware, which is situated in cab of engine driver. This system would include database of all traffic signs with allocated information about content of traffic signs and the method of engine driver notification. It includes a visual warning on the screen and audio warnings.

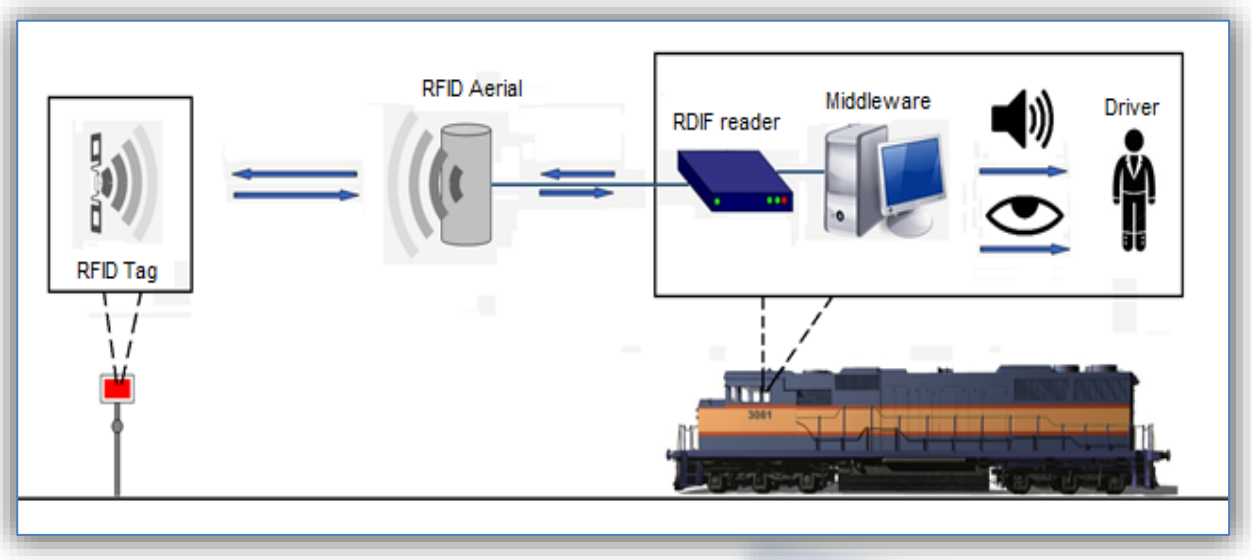

Figure 3. Suggestion of RFID tags application on traffic sign in railway transport

In this way, it will be possible to read the traffic sign not only by visual means but also through the transmission of information by electronic equipment, which reduces the possibility of overlooking this marking.

5. CONCLUSION

Application of RFID technology in railway transport is suitable solution for all of plants, which do in this branch, and it provides ample space for data collection. After the subsequent processing and statistical evaluation of their, they secure the enterprises from the current approach more effective and safer alternative. This system brings benefits in terms of increased comfort and productivity drivers, fuel economy, reduced administrative and personnel cost (mistakes and errors) and reduce the delays.

The future research may be directed to the application of RFID technology to other areas such as engineering, mining, civil engineering etc.

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