RFID Technology as an Inventory Tool for Future Emergency Service Vehicles

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Abstract: - A modern emergency service vehicle carries a lot of equipment, for example Finnish Police cars are equipped with an average of about 100 different types of equipment.It is extremely important to be sure that all needed tools are available in field operations. The objective of this research paper is to examine the suitability of RFID technology in law enforcement field operations, such as the locating, detecting and identifying of equipment in the emergency vehicles. The police departments have numerous vehicles and pieces of equipment that at the moment are identified and tracked manually. According to our field tests within a real police car, RFID technology's biggest benefits are improved work quality and time saving. The results show that the remote identification, enable the police to make a car equipped with an inventory of up to three times faster than by hand.

Key-Words: -Emergency service, Emergency vehicle,RFID, Law enforcement, Police car, Field testing, RFID-technology,MOBI project

1 Introduction

A modern emergency service vehicle is a complicated combination of technology and it has to survive in different conditions depending on the usage. It has to be reliable, it has to be flexible, it has to be able to carry people and equipment and it has to provide electricity for the increasing amount of electronic devices.The target of the 'Mobile Object Bus Interaction (MOBI)' research project is to create a common ICT hardware and software infrastructure for all emergency vehicles. This infrastructure includes devices for voice and data communications, computers, screens, printers, antennas, cablings, and additionally, interlinking with factory-equipped vehicles' ICT systems is researched [1].

Emergency service vehicles have to be ready to service on 24/7 basis. Preventive maintenance acts vital role to guarantee emergency vehicle operation preparedness but maintenance procedures during and after working sift are important too. As a part of the MOBI project,Häyrinen's study[2] covers what maintenance processes are integrated into daily routines in the police and rescue organizations. The main focus of the study was to describe current maintenance processes on the field. Häyrinen has conducted 19 interviews among security professionals from police and rescue organizations during her study.

A modern emergency service vehicle carries a lot of equipment and it is extremely important to be sure that all needed tools are available in field operations. The objective of this research paper is to examine the suitability of RFID technology in law enforcement operations, such as the locating, detecting and identifying of equipment in the emergency vehicles. The police departments have numerous vehicles and pieces of equipment that at the moment are identified and tracked manually. The demand for this study has arisen from an earlier need charting undertaken as part of theMOBI research project.

2 RFID Technology

Radio frequency identification(RFID) is a general term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object wirelessly, using radio waves. This is sometimes referred to as contact-less technology and a typical RFID system is made up of three components: tags, readers and the host computer system.

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2.1 Tags

An RFID tag is a tiny radio device that is also referred to as a transponder, smart tag, smart label or radio barcode. The tag comprises of a simple silicon microchip (typically less than half a millimetre in size) attached to a small flat aerial and mounted on a substrate. The whole device can then be encapsulated in different materials (such as plastic) dependent upon its intended usage. The finished tag can be attached to an object, typically an item, box or pallet and read remotely to ascertain its identity, position or state [3]. Fig.1 shows examples of RFID tags.

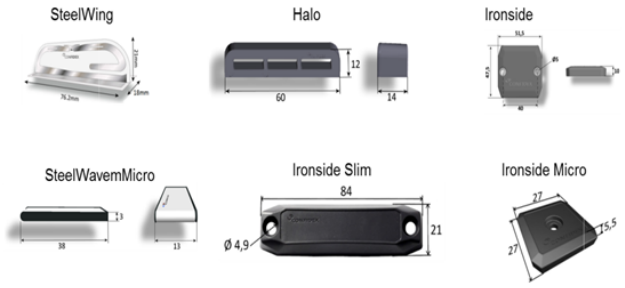

Fig.1 Different RFID tags

2.2 Reader

The reader, sometimes called an interrogator or scanner, sends and receives RF data to and from the tag via antennas. A reader may have multiple antennas that are responsible for sending and receiving radio waves [3]. Fig. 2 shows Merlin UHF RFID Cross Dipoli handheld reader that has been applied within this study.

Fig.2 Merlin UHF RFID Cross Dipoli handheld reader

2.3 Host Computer

The data acquired by the readers is then passed to the host computer, which may run specialist RFID software or middleware to filter the data and route it to the correct application, to be processed into useful information.

2.4 Automatic Identification

RFID technologies are grouped under the more generic Automatic Identification (Auto-ID) technologies. Examples of other Auto-ID technologies include Smartcards and Barcodes. RFID is often positioned as next generation barcoding because of its obvious advantages over barcodes. However, in many environments it is likely to co-exist with the barcode for a long time.

3 Research Method and Process

The study was conducted as a case study (Case Study Research Analysis). This research method was chosen as a case study aims to collect a comprehensive data set of source material and to further describe the subject matter in depth. Overall, according to Yin's case study framework [4], shown in Fig. 3, of the study are useful in situations where the applied understanding of how or why something is practical situations. The study attempts to proceed in accordance with Yin's iterative phasing according to the scientific precision met at a sufficient level. One of the most important issues in order to obtain the scientific accuracy of the case study is the use of multi-source evidence.

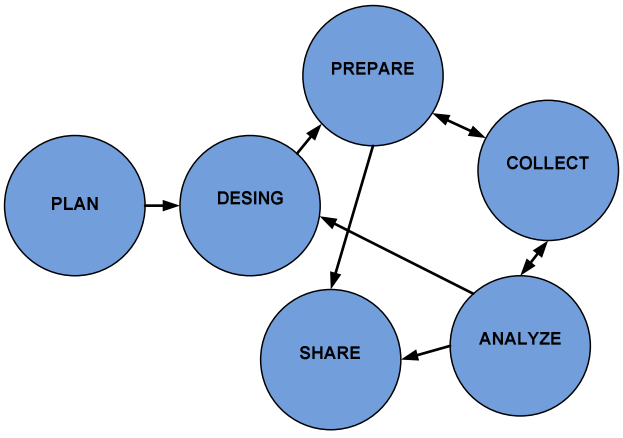

Fig. 3 Yin's case study framefork

This case study has been deliberately designed to be part of MOBI project.The original research question was: How can RFID technology be utilized in law enforcement operations?The unit of analysis of the case study is the concept how to improve the

maintenance of emergency service vehicles so that they could be ready to service on 24/7 basis.The data collection was done via six different sources: 1) interviews; 2)documents produced during the MOBI project; 3)archives; 4) free observation; 5) participatory observation during the field tests and 6) artifacts. The original Finnish test reportis available via the Internet [5].

3.1 Field tests

During the field tests, applicability of the RFID technology in the emergency service vehicles was verified. Field testing was carried out in the MOBI demo vehicle, shown in Fig. 4, which is a real police car. The identification was tested only via the handheld reader shown in Fig. 2 So, the situation was the closest possible to the deployment phase.

Fig. 4 The MOBI demo vehicle

Table 1 lists the selected models of tags.Fig 5 shows where the tags were placed duringfield testing.The tags were placed in seven different storage areas: 1) under front bench, 2) fire extinguisher, 3) inside the upper metal bin 1, 4) inside the upper metal bin 2, 5) inside the upper metal bin 3, 6) inside the lower metal bin 1 and 7) inside the lower metal bin

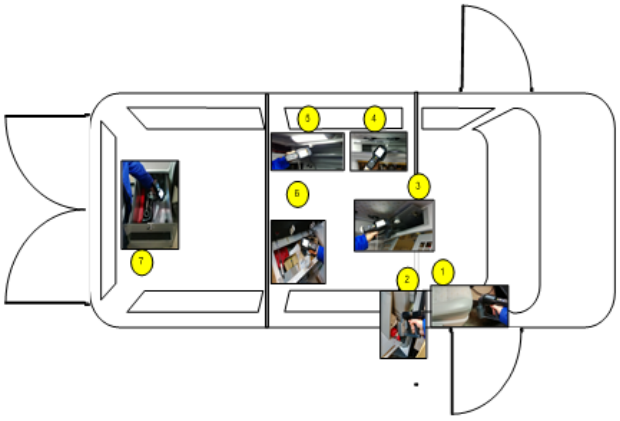

Fig. 5 Field test environment

Table 1 Selected tag models

Manufacturer	*Model*	*Size (mm)*	*Frequency (MHz)*
Conidex	Conidex Halo	60*12*14	865-869
Conidex	Ironside	51*47.5*10	860-960
Conidex	Ironside Micro	27*27*5.5	865-869
Conidex	Ironside Slim	84*21*10	860-960
Conidex	Steelwave Micro	38*13*3	865-928
Conidex	SteelWing	76.2*18*21	865-928
Conidex	Survivor	224*24*2	865-869

2.RFID tags were read from a distance of about 20 cm.

4 Results and Discussion

Identification process is shown in Fig. 6.The turnaround time for each test was about 3 minutes. Table 2 shows results of the analysis of observations of how well the RFID tags were able to read a police car's different storage areas. The measurement results (two rounds) were comparable with each other.

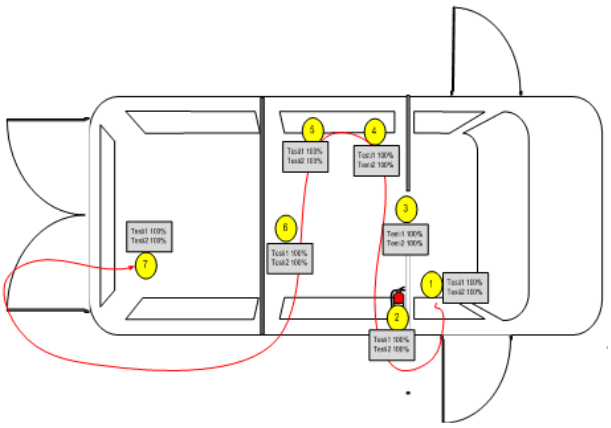

Fig. 6 Identification process

Table 2 Measurement results

Police car	Tags		Test results (identifying)	
Storage areas	Manufacture	Model	1	2
1, 2, 3, 4, 5, 6, 7	Confidex	Confide100 Halo	100 %	100 %
1, 2, 3, 4, 5, 6, 7	Confidex	Ironside	100 %	100 %
1, 2, 3, 4, 5, 6, 7	Confidex	Ironside Micro	100 %	100 %
1, 2, 3, 4, 5, 6, 7	Confidex	Ironside Slim	100 %	100 %
1, 2, 3, 4, 5, 6, 7	Confidex	Steelwave Micro	100 %	100 %
1, 2, 3, 4, 5, 6, 7	Confidex	SteelWing	100 %	100 %
1, 2, 3, 4, 5, 6, 7	Confidex	Survivor	100 %	100 %

RDID technology allows checking the locating of equipment even inside metal bins. Also, identification of equipment is easier.Within our field

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tests, the emergency service vehicle equipment inventory process time was improved from 30 minutes to less than 10 minutes. The conducted field tests resulted in a positive outcome and the benefits of RFID technology in this application are indisputable.

The most significant benefits of RFID technology are improved work quality and time saving. The results show that the remote identification, enable the police to make a car equipped with an inventory of up to three times faster than by hand. The utilization of RFID technology in emergency service vehicles will improve the police work reliability and the work can be made safer, more efficient and economical way.More efficient equipment inventory allows the police to spend more time on patrol and at the same time assisted with a better safety of citizens.

The current trend is that emergency service vehicles will more and more be used as a mobile office [6].This means that also the number of carried tools increases day by day which means longer inventory times.

5 Conclusion

Law enforcement authorities' main need is to maintain their core services with significantly reduced budgets.This means to apply more ICT and digital services, also in the field. Police cars are equipped with an average of about 100 different types of equipment. Police cars, inventory means a weekly basis the number of hours used in the examination of goods, all of which are out of from normal work. The study concludes that RFID technology is a completely viable option in law enforcement operations. The conducted field tests resulted in a positive outcome and the benefits of RFID technology in this application are indisputable. The study revealed that the subject organizations need to provide employees with a faster way to complete an inventory of emergency servicevehicle equipment, by utilizing RFID technology tools and applications. The next step will be a larger scalepilot project. Its duration, scope and objectives must be defined in conjunction with the police. The pilot is good to implement in the right operating environment within a real police car. Police cars' equipment must be accurately determined in co-operation with the police and after that selected a right type of RFID-tag and RFID-Reader.

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