

Models, methods and technologies to support the training of drivers involved in the transport of dangerous goods

Mauro Benza¹, Stefania Briata², Massimo D'Incà¹, Domenico Pizzorni², Cesare Ratto²,
Massimo Rovatti², Roberto Sacile¹

¹ Dipartimento di Informatica Sistemistica Telematica, Università di Genova, Italia

² Eni LogSec, piazza della Vittoria 1, Genova, Italia

The paper describes practical models, methods and software technologies as training supports on hazardous material transport by trucks. Specifically, the work developed by Eni and the Department of Communication Computer and System Sciences of Università degli Studi di Genova concern an information system to train truck drivers. The information has been modeled in concepts forming an ontology on different aspects of the transport of dangerous goods, simplifying both the creation of courses, the profile of the training received by each driver, as well as the possibility to verify the effectiveness of the training. In fact, the information system has also a distributed component, allowing to verify the effective training of drivers directly on their palm top. The objective is to assure a continuous education widely distributed. The presentation illustrates the results of this work.

1. Introduction

There is no doubt that an effective training may affect the safety aspects in peculiar transportations, such as the one of dangerous goods. Training may not only include regulations, technical and procedural aspects, but also important psychophysical aspects such as how to manage fatigue (Samuel et al., 2010; Arnold et al, 2001). The provider of training may be different according to National legislations. In Canada and the US, it is the role of the employer to ensure appropriate truck-driver training for the transportation of dangerous goods (Kuncyć et al, 2003). In Sweden and The Netherlands, a competent national authority must accredit training institutions or trainers and monitor the examination of truck drivers (Kuncyć et al, 2003). However, all training system approaches pursue the same goal: to ensure appropriate training and prevent the accidental release of dangerous goods during transportation.

Both approaches have some drawbacks. For example, in general, it is difficult to state that all employers ensure proper truck-driver training for the transportation of dangerous goods. On the other hand, the involvement of national authorities is important for truck-driver training quality and control. Hence, without some standards, training does not always meet actual driver tasks and employer expectations.

This work proposes one model of continuous training in the field of dangerous goods transportation as currently proposed in Eni Secondary Logistics. This model supported by different technologies and methodologies allows to make training in this field measurable and objective, as well as verifiable by quality assurance processes. In this paper, some aspects of this model are briefly sketch out.

2. Models, methods and technologies

The work developed by Eni and the Department of Communication Computer and System Sciences of Università degli Studi di Genova permitted the implementation of TIP (Transport Integrated Platform) a web platform for the management of dangerous goods transportation by truck. In this work we are going to examine the section of TIP that takes into account the training of truck drivers.

2.1 Training methods

The TRAINING section of the TIP is dedicated to online training on health, safety, environment and quality (HSEQ) and is addressed to operators in the transport sector.

It is a Learning Content Management System (LCMS) that permits to monitor the training process and manage the contents with the aim of preventing and reducing the risk of transporting dangerous goods, ensuring also high standards of performance. The approach chose for the platform is called blended e-learning: the users are trained by combining and using different activities such as classroom training with the presence of a coach and self learning via Web. The coach finds in TIP a manual for each course, which can be viewed and downloaded from the site.

The training iter of each user is tracked and stored in the data base and every curricula is updated in real time. Authorized users can manage the overall construction of courses and monitor the activities carried out by participants.

In TIP, the courses are structured into modules, the modules are divided into chapters, which are built by single concepts that are associated with the questions that will appear in the tests. The users can watch online the slideshows that will be presented in the lessons and can perform self assessments to practise the final tests.

The final tests are composed of randomly selected questions from the ones that are related to the course previously viewed through the online slide show and they are that are stored in the system only after the coach has made its corrections.

The TIP is equipped with a statistical engine that allows complete control of the state and level of training courses, questions, answers, and user's CVs.

2.2 System architecture

The system architecture of the TIP training section is basically constitute of three objects

- A data platform, developed using Microsoft SQL Server. In this platform, organized with a relational architecture, are stored different information: the training course organized in module, chapter, concept and question. The template of the tests. The users information and profiles including historical data on the

courses took with the results of the tests and the question daily proposed by the system.

- Some web pages, developed using the Microsoft .NET framework. Those pages allow to insert or update courses and tests, manage classroom training sessions, visualize users CV and perform and extract statistical data from the database.
- A windows service, developed using Microsoft .NET framework that permit to retrieve daily question from the database and send it to the users via the handheld equipment and / or by e-mail.

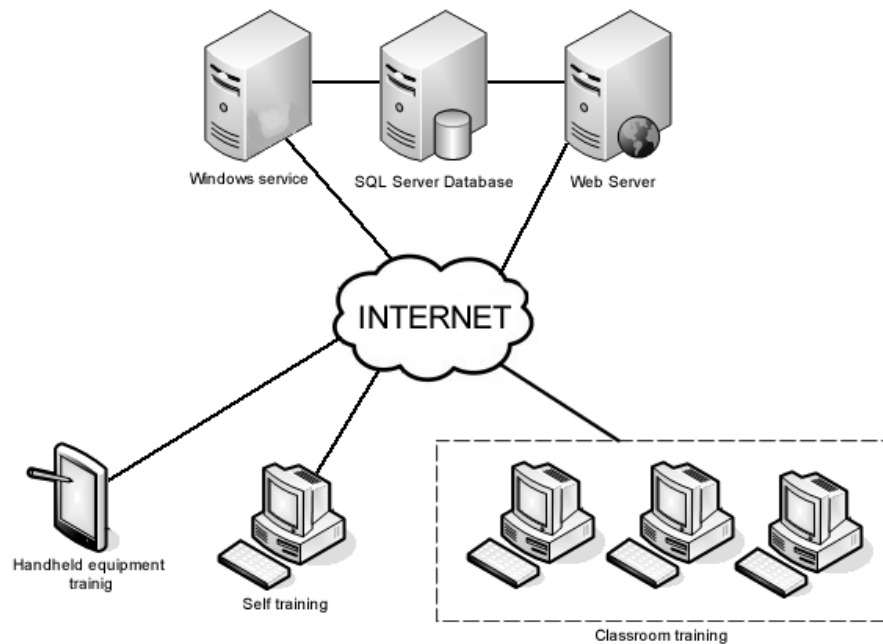


Fig. 1. System architecture.

2.3 Training with TIP

The list of courses currently available in TIP is the following:

1. Psycho-physical performance at driving
2. Basics of logistics regulations
3. Environmental impact of petroleum products
4. Fire risk
5. Incident case studies
6. Toxicity risk
7. Electrostatic risk
8. Manual handling risk
9. Dangerous goods: transport by road
10. Loading and unloading of petroleum products
11. Safe driving
12. Transport instructions
13. Personal protective equipment

14. First aid
15. Operational procedures
16. Security
17. Foundations of road transport: gasoline tanker truck and lubricants
18. ADR training
19. Pipeline: Accidents prevention
20. Pipeline: ISO 14001
21. Pipeline: Management of water and waste treatment
22. Pipeline: Basics on work permits
23. Pipeline: Atmospheric emissions
24. Pipeline: Safety signs
25. Pipeline: Incident case studies
26. Pipeline: Pollution and soil remediation
27. Pipeline: Waste management
28. Pipeline: Noise
29. Training for the trainers

For each course is available - on line - a detailed description of the content and a slide show to allow the trainer to do his presentation to the trainees.

For each course registered in the database, it is possible to create training sessions with all information needed to produce statistics (date of the lesson, location, duration, teacher's name, names of the participants, etc.).

At the end of the course each participant has to do the final test. The teacher can explain again some concept and modify the score if the user has demonstrated to understand.

2.4 Training with SafetyGame

Following the guiding principle of "lifelong learning", starting from the day after the final test, each user everyday receives a question regarding the course that he has followed.

The name of this system is SafetyGame and it is designed to increase the extent of learning and to keep updated all the participants regarding HSEQ topics. The SafetyGame is provided via email or via smart phone and evaluates the quality of the answer (right / wrong) and the score reached. If the answer is wrong, it's possible to send to the user a "mini course" or, simply, the right answer with an adequate explanation.

With only 5 minutes of training per day ("training pills"), it is possible to keep prepared the users, in particular the drivers, that can't spend too much time in front of a PC and manage the classroom session only on demand or if there are proven difficulties in learning.

3. Results

At the beginning of our experimentation in 2002 we stored into our database 726 users and 15 courses. At the end of 2008 we reached 1763 users and we proposed 29 courses,

adding also courses not specifically intend to truck drivers but to all users that are involved in dangerous material transport.

Considering that the average course duration is 4 hours and that we had supplied 1013 training session with an average of 7 users for each training session we achieved 28364 hours of training. With SafetyGame we also provide a continuous daily training corresponding to 30 hours/year of equivalent training for each user.

Table 1. users trained with TIP since 2007, partitioned by geographical area

Areas	Years						Total
	2002	2003	2004	2005	2006	2007	
North west	43	85	33	130	146	254	691
North east	161	153	47	101	233	59	754
Center	23	205	117	156	186	116	803
South	151	71	30	417	518	266	1453
Sicily	12	38	15	24	110	185	384
Sardinia	71	32	4	33	45	82	267
Total	461	584	246	861	1238	962	

With TIP and SafetyGame, Eni R & M - Logistics Secondary achieves the following:

- Provide content and tools for training;
- Keep constantly monitored the preparation of the users;
- Reduce training costs;
- Take immediate action in case of educational deficiencies.

4. Conclusions

The training section of TIP with its several tools allow to reach different goals. With the classroom training and tests we achieve the advantage of having the presence of a coach that give a more efficient training. With the self training we provide a tool to better focus at home the contents of the followed courses and improve the preparation. Last but not least SafetyGame allow to reach everywhere all users proposing daily questions on their handheld equipment in order to strengthen the personal knowledge.

In the future this platform can be upgraded with innovative tools to measure the degree of understanding of the subjects studied. It will be possible to provide an extra dedicated training focused on reducing knowledge lack.

References

- R. Kuncyć, C. Laberge-Nadeau, T. G. Crainic, John A. Read, Organisation of truck-driver training for the transportation of dangerous goods in Europe and North America, *Accident Analysis and Prevention* 35 (2003) 191–200
- P. H. Gander, N. S. Marshall, W. Bolger and I. Girling, “An evaluation of driver training as a fatigue countermeasure”, *Transportation Research Part F* 8 (2005) 47–58.
- C. Samuel, N. Keren, M.C. Shelley, Steven A. Freeman, “Frequency analysis of hazardous material transportation incidents as a function of distance from origin to incident location”, *Journal of Loss Prevention in the Process Industries*, In Press.
- Pauline K. Arnold, Laurence R. Hartley, “Policies and practices of transport companies that promote or hinder the management of driver fatigue”, *Transportation Research Part F: Traffic Psychology and Behaviour*, Volume 4, Issue 1, March 2001, Pages 1-17.