Intelligent transport Systems: how to manage a research in a new field for IS

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Abstract This paper sheds light on the management of a research project in a new topic for IS like the one of Intelligent Transport Systems (ITS). It describes and discusses the methodology adopted for a survey designed by the authors and experimented during a recent research on ITS carried out on behalf of an Italian Ministry. The paper presents the first results of this research and draw some conclusions on the problems that have to be faced in order to successfully manage such type of research projects and to build a common knowledge base on ITS.

Introduction

Intelligent Transport Systems (ITS) have been defined like "tomorrow's technology, infrastructure, and services, as well as the planning, operation, and control methods to be used for the transportation of persons and freight" [1]. In spite of that, the official definition remains those given by the Commission of the European Union: "ITS mean applying Information and Communication Technologies (ICT) to transport. These Applications are being developed for different transport modes and for interaction between them (including interchange hubs)" [2].

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Currently there exist several works on specific ITS systems [3, 4, 5], on available technologies [6, 7], or possible fields of applications [8, 9]. Other works try to recall the history of these systems and to create a state of the art of these technologies both in Europe and in the rest of the world [10, 11]. Anyhow, all these studies come from the transportation engineering discipline and consequently ITS have never been examined by the IS discipline. Moreover, no existing research can provide a comprehensive picture of all the ITS initiatives carried on in a specific country, namely in Italy.

The present research has been commissioned by the Italian Ministry of Infrastructures and Transportations in 2008, and has been finished in the end of 2009. The original goal was the analysis of the informatics and organizational solutions adopted by a sample of ITS projects to be analyzed in depth. Since the very first beginning, the fields of Italian ITS systems appeared roughly defined, as a complete map of ITS project applied on the Italian territory was not available, nor was their current state of the art known. It has therefore not been possible to select a statistically valid sample for the analysis originally planned. This circumstance challenged the planned research and required a shift in the goal to be pursued. The primary objective of the research became then a survey – as wide as possible, but not necessarily exhaustive –, of ITS projects currently started on the Italian territory, and the construction of a map of these projects on the basis of a set of parameters necessary to meaningfully classify them.

The availability of a comprehensive knowledge of previous experiences in the field, both experimental and applicative, is a preliminary condition necessary for the promoting of new initiatives in the ITS sector, and for new, and deeper, research initiatives on the ITS topic.

Research Methodology

In the context depicted in the introduction, this research has followed an exploratory approach, both for the novelty of the ITS research field, and for the blurred definition of its scope (as clearly explained later in the text). The presence of an area of interest particularly wide, divided in several layers not univocally defined, has firstly requested the thorough definition of the scope of the research.

First of all the research team has focused on the identification of a taxonomy of ITS systems that could be used as a guide to orient the design of the subsequent research activities and of the instruments that were going to be applied in them. Currently there are some taxonomies developed to classify ITS projects [12,13] usually built over highly articulated structures that relate the scope of the systems and the technologies used [14]. For the needs of the present research the taxonomy adopted has been taken from some official documents [15, 16], since it has been judged as the most clear and exhaustive, showing a net distinction among the terms used in it. The taxonomy adopted is again based on the scope of the systems and is composed by the following categories:

- Traffic and mobility management and monitoring;
- Information to customers;
- Public transportation management;
- Fleet and freight transport management;
- Automatic payment systems;
- Advanced control of vehicles for security in transports;
- Emergencies and accidents management.

Regarding the boundaries of the research, the projects have included in the survey on the basis of the following selection criteria:

- Projects started or promoted since the year 2000;
- Projects with an experimental or a deployment aim;

- Projects with at least an Italian partner or that have to be/been implemented in the Italian territory;
- Project centred on the following transportation modalities (and their interconnections): car, rail, ship, plane;
- Projects funded by:
    - The European Union: the Research, Energy, Transport, Information Society, and Media Enterprise and Industry funding programmes have been taken into consideration;
    - 6 central Italian administrations on the basis of the strategic role that ITS systems play in the policies for economic development, transport, security, and environment;
    - By one or more of the 21 Italian regions;
    - Promoted by the 4 most relevant municipalities in Italy. Roma, Milano, Torino, Napoli.

The wide abundance of the characteristics of the sources from which the selection of ITS projects has been made has made the adoption of a different research strategy:

1. Based on the information available on web sites;
2. With the performing of an electronic survey.

The first strategy has seen two different steps: i) the use of data bank of public access queried with specific search keys to identify the details of the different projects and ii) the identification, selection, and analysis of project documents, in order to gather more detailed data (like the typology of the project, the list of the proponents of the project, the scope of the project). This research strategy could be applied only for the sources available from the European Commission. In no other case, this strategy could be worth pursued because the absence of specific search engines capable to recognize ITS projects.

The only exception to this rule is the one of a central administration (MIUR: the Italian Ministry of Education University and Research). In this case, to ensure

a more punctual research, given the limitations of the selection criteria offered by the two database queried (Arianna and Me.Mo.Ri) the Research Directorate General grants has been asked to fill an electronic sheet with the fields that were necessary for the data collection.

The second research strategy has been based on an electronic survey that has been sent to a selected sample of recipients in the position to provide meaningful data on the ITS projects promoted by their administrations. This strategy has been used in the case of the remaining central administrations that have to be included in the survey, for the Regions, and for the Municipalities.

Both the electronic survey and the queries on publicly available database were targeted at obtaining the following details on the ITS projects:

- General details: name, abstract, website, and project type (research, development, deployment…);
- Partnership: coordinator and others partners;
- Activities: starting date, ending date, current state of the art, localization of the project;
- Financial details: financial dimension of the project, dimension of the grant, funding sources;
- Typology of the ITS system: scope, modality, and aims.

Once ready, the survey has been addressed to 2 recipients to test and validate its contents.

The recipients of the survey have been identified by means of institutional websites of regional and municipal administrations. In particular the survey has been sent to the Directorate General (DG) responsible for the following sectors: transportations, mobility, security, and economic development.

Later on, the survey has also been extended to the Agencies for Mobility both of the Regions and Municipalities (when available), or to other structures that, on the basis of the description of the activities performed, have been judged as possible targets worth contacting.

The data collection process has followed 5 different steps (some of them have been iterated more than once):

- First contact (over phone) with the administration to: identify the recipient(s) of the survey, illustrate and clarify the data that have to be collected and the methodology to be used for this data collection, get some feedback regarding the availability of the recipient to fill in the survey and the expected amount of time he/she requested before returning the survey;
- Survey dispatch along with a brief description of the research and the instructions to fill it in;
- A final telephone contact to provide assistance (when required) and to find an agreement on the return date of the survey;
- A remind (via mail or telephone) in the case of delays in the responses;
- A final contact (via mail) to thank those who have sent the data back, to ask them to check the data they have submitted for completeness or integrity, and to ask them to inform the research team in the case they had new information on further ITS projects.

To support the data collection process, the following artefacts have been designed, realized, and used:

- An Access database containing all the details of the projects investigated;
- Software to manage the database of all the data gathered on the ITS projects (called "Banca dati sui Progetti ITS in Italia") that allows to: update data already in the database, insert new data, and look up the data available in the database.

First Results

Following the first research strategy, 110 (???) websites have been queried, 2100 ITS projects have been identified, and 175 have been selected. This large gap is

mainly due to the inadequateness of filters available in the search engines that has forced the research group to, first of all use a broader set of research criteria, and then manually check all the results to identify good projects and discard not relevant ones.

Following the second research strategy, instead, 71 different administrations, with an average of 2,3 DG each, have been identified as potential recipients. Along with the contact process the number of recipient administrations has grown to 76 (61 among regions and autonomous provinces, 9 municipalities, 6 ministries), with an average of 3 DG each.

In total the research group has done 385 telephone calls, and has sent circa 300 e-mails: on average 5,42 phone calls have been made, and 4,89 emails have been sent per each recipient.

The number of contacts directly testifies the difficulties faced in the identification of the right recipient to whom the survey has to be addressed and the delay in the return of a filled survey. The inertia in the process can be addressed to the set of steps necessary to directly interact with the head of the identified administrations, or to the subsequent discovery of a possible recipient, different from the one that has been firstly identified.

Besides the time necessary for the identification of the right recipient, also the time required by the administrations to fill in the survey and send it back have been quite long. It is anyhow relevant to point out that, notwithstanding these difficulties, there was a significant willingness to take part into the survey and to provide information by recipients identified (response rate was quite high: 74%). This testifies that an activity to aggregate and disseminate information on this topic, as for example by creating a specific professional community, should be considered as worthwhile.

At the end of the selection and data collection process, 159 (forse 83? somma qui sotto o fai la sottrazione più giù) projects have been identified divided from the following sources:

- 34 projects from the survey addressed to regions and autonomous provinces;
- 44 projects from the municipalities;
- 5 projects from the Ministry of Infrastructures and Transportation.

These projects sum up to the 175 identified from sources from the European Commission and to the 76 selected from the project files sent by the MIUR (as detailed before) for a total of 334 projects analyzed.

Discussion

Some general considerations regarding the application of the method stem out of the described research experience.

A first outcome regards the field of ITS systems that is so far, not clearly described and identified. It is in fact quite difficult to identify inside the administrations the subjects that have a direct competence on the topic, since there are no specific responsibilities devoted to the topic. Adding to this, also the difficulties of the recipients to identify what the acronym ITS or the expression "Intelligent Transport Systems" exactly refer to, has also to be mentioned.

A second aspect worth of mention is that the identification of information sources and the access to data is again difficult in this topic. The research group has noticed a certain degree of approximation and incompleteness of the information available on the websites, even on those official ones. Moreover, also in the cases of apparently complete catalogues, the subset of projects eventually referable to the ITS domain is not always directly selectable.

Finally, data available on ITS project are many times scarce and incomplete. Sometimes only information like the name of the project, the name of the coordinator, and a contact (usually without a telephone and mail). Frequently a website for the project, that could be a source to deepen the research, is not available.

These considerations support the claim that the survey of ITS project carried out during this research is not complete, and that the information gathered are not to be considered exhaustive, due to the wrong, or misleading, interpretation of ITS from the addressed recipients.

To this regard, the definition of a compact taxonomy of ITS projects, like the one we have adopted in this work, but possibly more clear and coherent, appears as a necessary step. Such a taxonomy should be properly disseminated among all subjects potentially interested, in order to create a necessary shared knowledge base that could serve as a common vocabulary to ease mutual communication and understanding in this topic.

Also it has to be noted the absence of a single entity or subject that collects, organizes, and disseminates information on the numerous initiatives still running or already closed, preventing the generation and the diffusion of knowledge on a highly innovative field for the application of advanced technologies.

The regular feeding of several knowledge sources, or even one single catalogue of projects thoroughly designed and constantly updated, are of particularly usefulness taking into account the fact that the initiatives for the creation of ITS systems are, at the same time, attracting (for novelty, capability, and for the potential of funding available) and challenging, especially for everything that concerns the organization and management of services based on them.

The availability of a patrimony of experiences, among which some possibly similar to the new one to be designed, can contribute as an incentive to the diffusion of ITS systems and, at the same time, to the improvement of technological and organizational choices.

The current research might then be considered as a first step in this direction, bringing a patrimony of data, but also of witnesses and contacts, with whom plan future initiatives with analogous objectives.

Conclusions and Future Research Plans

This paper has introduced an exploratory research devoted to the ITS projects, illustrating the designed methodology, the difficulties encountered in the research effort, and the choices made to face them.

The topic of ITS systems is a research area that has so far been completely neglected in IS. The description of the method adopted, of the results obtained, and of the characteristics of this research area – in terms of available shareable knowledge and of specific problems – offer other researchers in IS a knowledge base starting from which they can promote further and more deepen investigations.

Regarding the research described in this paper, the efforts will proceed, firstly by means of the elaboration and discussion of the data gathered on the ITS projects during this survey. Later on, on the basis of the results of the discussions on these data, we plan to extend the identification of ITS projects and the deepening of some aspects connected to their organization and to the use of information and communication technologies.

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