AIDER

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Accident Information Driver Emergency Rescue

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Short Description:

The aim of this document is to present a complete overview of AIDER project covering the initial objectives, the approached adopted, the consortium composition and partners role. Here are also presented the main deliverables, technical achievements reached and indication about not restricted documents.

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1 GLOSSARY

Acronym	Description
AIDER	Accident Information and Driver Emergency Rescue
APU	AIDER Processing Unit
BB	Black Box
BBDLU	Black Box Data Link Unit
CC	Control Center
CS	COSPAS/SARSAT http://www.cospas-sarsat.org/
DATEX	DATa EXchange
DB	Data Base
DIS	DISpatcher
DLU	Data Link Unit
DSS	Decision Support Software
ESP	Emergency Service Provider
FLC	Forward Looking Camera
GUI	Grapic User Interface
HMI	Human Machine Interface
ISP	Internet Service Provider
MCC	Medical Control Center
PAL	Phase Alternation Line
RCC	Road Control Center
SARSAT	Search And Rescue Satellite-Aided Tracking
TCC	Traffic Control Center
UTC	Coordinated Universal Time
VGA	Video Graphics Array
WMV	Windows Media Video
WP	Work Package

2 PROJECT OVERVIEW

In these years the number of vehicles present on the road is increasing enormously and the fact that transport is a key factor in modern economies is a reality. Nowadays the most critical issue related to road traffic is the number of accidents, which is still very high.

In order to achieve the goal to drastically reduce the number of accidents on the road, car manufacturers in Europe are now working to develop Intelligent Transport Systems (ITS) and Services towards the aim defined in the White Paper of the European Commission of reducing the number of fatalities in the European roads by 50% in 2010.

The availability of real time information is becoming a key factor for the improvement of traffic safety, especially in all cases of emergencies. In these years, the European Commission is promoting an Integrated Safety approach to build a cooperative chain of accident prevention, mitigation and rescue efficiency.

Looking to road safety issue there are two ways to proceed:

- **Accident prevention**: the design and development of advanced driver assistance systems extended to the application of communication technologies to enable the availability of information for the drivers beyond the operative range of the on board sensors. For preventive safety the cooperation of vehicle and infrastructure is also taken into account and it is a fact that some vehicle ahead can forward information about road condition to the forthcoming vehicles.
- **Optimisation of rescue operation** in terms of time efficiency and cost reduction. Rescue operators and control centres currently depend on the notification of accidents through telephone calls and the location of the accident cannot be accurately determined in 40% of the cases. The key factor is the availability of more information coming from vehicle so to determine in a precise way the accident location and its severity.

AIDER is a European project co-funded by the Information Society Technologies Programme within the initiatives of the 5th Framework Programme. The project started in September 2001 and it is now finished.

AIDER project is focused on the "**optimisation of rescue operation**" and in particular it is aimed to define a complete chain for the optimisation of rescue management procedure considering the whole sequence starting from accident notification till to rescue means dispatching.

Within this scenario the AIDER project analysed the complete emergency call architectural chain, identified the main requirements for all the involved stakeholders, designed and developed the mandatory modules to build such architecture: the in vehicle equipment, the control centre, the communication link. Moreover concerning the in vehicle equipment a specific sensor suite has been identified accordingly to the requirements from the stakeholders involved in the rescue process. Looking at the emergency call public service AIDER solution has been analysed in terms of social benefits and economic impact. Results from cost benefit analysis are reported within this document.

AIDER chain has been analysed from the standard point of view and a comparison with the eCall Working Group activity has been done so to localize the developed architecture in the European context.

3 PROJECT OBJECTIVES AND APPROACH

The main objectives of AIDER project are:

1. To develop an efficient Rescue Management System able to improve rescue operations;
2. To reduce the time of intervention and optimise rescue procedures;
3. To create a direct co-operation between an on-board System and a Control Centre.

The common concept which is the base of the mentioned objectives is the availability of a direct co-operation between: on-board system for Automatic Incident Detection, to be installed in vehicles, and Control Centres, dispatching the emergency calls to the “Rescue Services”.
The core of the concept is the presence of a dedicated on board equipment able to automatically identify the accident and to generate a SOS call, but in the meanwhile responsible to collect information about vehicle’s status and passenger biomedical status, about precise accident identification, about number of people on board and vehicles involved in the accident but also typology of crash.
Analysing the concept from the control centre point of view, a big added value is represented by the availability of: precise accident location identification, number of passengers involved and type of injury, biomedical information. In this way the operator is allowed to identify accident severity and involve the right rescue means.

In order to accomplish the mentioned tasks the consortium, composed by 10 partners of 5 different countries, started with the analysis of the state of the art concerning emergency call infrastructure and collecting requirements from a number of strategic stakeholders.
In parallel a survey about innovative technologies and about in vehicle black box requirements have been performed.
Since the central theme of the project is the passenger medical status identification, the activity has been done in cooperation with medical support so to understand not only from engineering point of view, but also from the medical know how, which actions have highest priority in the severity estimation and in the first aid.

The communication link is very important in the overview of AIDER architecture. At this purpose special analysis have been done in order to identify the right technology to use and to define the strategy to adopt in case of failure of the main communication channel. Dealing with emergency services a big impact has been assign to the consideration of back up communication strategy.

In more details, the main scientific and technological aims of the project are listed below:

- To identify the main *requirement* from stakeholders point of view concerning emergency call and rescue process optimisation;
- To identify the modules composing the emergency call *architecture*;
- To design and specify each modules towards the *implementation of a prototype complete solution* and to define the *message set* exchange between vehicle involved in the accident and control centre;
- To define the strategy to process and transmit video stream concerning in vehicle scenario. A specific *video compression algorithm* has been defined and implemented in the project;
- To define the interface between AIDER control centre and existing *road control centre*. This part of the chain has been considered very useful in the case the accident is located in a road managed by a dedicated control centre which has information and knowledge about traffic condition and traffic composition (example in case of presence of dangerous goods) and which is in charge to manage the VMS;
- To integrate the in vehicle prototype system in a FIAT car, to set up a prototype AIDER control centre and to implement the interface towards Torino-Milano Motorway control centre;
- To test all the AIDER prototype chain and perform technical assessment in addition to the analysis of social impact due to the introduction of AIDER system on the market
- To investigate European state of the art in terms of emergency call management in relation to car maker and to public authorities point of view;
- To perform a risk analysis looking also to legal and ethical implication related to the presence of AIDER system in the vehicle.

3.1 Description of work

The project work is structured in six Work-packages, to achieve three main clusters of results: the specification of the AIDER System components, the development of a prototype AIDER System and the demonstration and evaluation of the AIDER System.

In this sense once identified the problem and so the project aim and reference scenario, the consortium identified the central stakeholders which are involved in the actual infrastructure or should be included in the future defined architecture. A preliminary state-of-the-art analysis of existing rescue management procedures, sensors, communication technologies and accident statistics have been done and the AIDER Concept and the System operational and technical requirements have been defined.

The following step has been the architecture and specifications so to arrive to the implementation phase. Implementation is concerning the vehicle equipment and the control centre, including the algorithms for accident reconstruction and "decision support".
Once implemented the prototypal architecture the aim has been the testing in order to verify the correct integration of the AIDER sub-systems and the overall system performances.

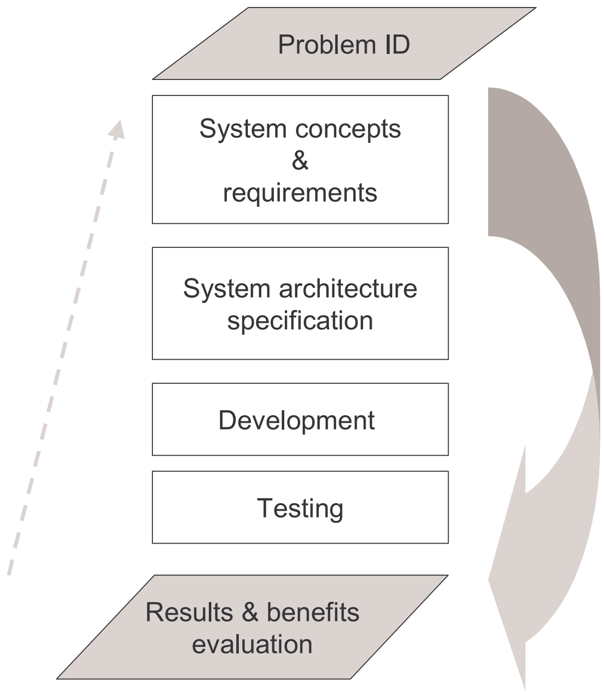

Figure 1 – AIDER work structure and adopted approach

The system exploitation activities implies the analysis of the AIDER System risks, benefits and constraints for a future introduction on the market, the identification of the ethical and legal implications of the System and the arrangement of the dissemination activities. A specific Work package has been dedicated to the management and co-ordination of the technical, administrative and quality control activities.

4 PROJECT RESULTS AND ACHIEVEMENTS

Accordingly to the original work plan, within AIDER activities it is possible to identify some relevant steps:

- Analysis of the state of the art and the concept definition;
- User requirements collection relevant for the system design and development phase;
- Implementation of the complete architecture for overall testing and evaluation;

In parallel has been performed a social benefits evaluation in relation to the introduction of AIDER system in the market and the analysis of AIDER system risk and legal and ethical implication.

4.1 AIDER technical achievements

AIDER architecture is characterized by three main components: Vehicle System, Communication System and Control Centre (CC).
Within the project a complete chain has been developed in order to test and demonstrate all the system functionalities.

The vehicle prototype
The in-vehicle system includes: a sensorial equipment such as bio medical sensors to monitor the passenger status (blood pressure, heart frequency, oxygen saturation level); crash sensors to detect lateral, frontal and rear crash; 2 video cameras: one 360° degrees for in cabin view and one frontal camera for outside view (useful for accident dynamic reconstruction), and at least a recording on-board box: the APU (AIDER Processing Unit).
The APU is the real kernel of the system and fulfils two major goals:

- Data capture & recording in order to enable accident reconstruction (“Black Box”)
- Data capture & transmission to RC in order to enable efficient rescue efforts.

The AIDER on-board equipment is able to automatically detect emergency events and issue automatically and SOS call, even if the passengers are unconscious.
The central module, so called APU (AIDER Processing Unit), has the capability to acquire information from the on-board equipment (video cameras, bio-medical sensors, GPS receiver, vehicle’s sensors), to process the information and to store data in a flash memory cyclically updated. Thus, the APU monitors the passengers, the vehicle and its surroundings and store the required information for efficient accident reconstruction.

The APU works as a "black box" till the accident event. It is designed and installed according to strictly defined rules, in order to survive a crash and enable audio and data link communication among vehicle and Rescue Centre. After the crash, the APU is remotely controlled by the Rescue Centre.

The communication system

The communication link is the most important feature of all the architecture and makes possible to achieve AIDER goal. The communication system is implemented for the AIDER application to enable an efficient and reliable data interchange between the vehicles involved in the accident and the rescue forces. An integrated communication system, based on GPRS and satellite aided links, is used to enhance transmission coverage and system robustness in accident conditions.

A "default" communication system is based on GPRS technology, but, in case of failure due to really critical accident conditions, the APU is able to automatically switch to satellite backup beacon (SARSAT / COSPAS) communication.

In order to give the solution an international value, the communication is based on technologies available around Europe and also roaming issues has been taken into account.

The control centre

At Control Centre level, an "accident reconstruction" is performed processing the information sent by the AIDER vehicles and by possible infrastructures placed on the roads and monitoring the traffic.

This means that the Control Centre is able to analyse the data received from the vehicle, identify the type of accident and the severity, identify the number of passengers and involve the more appropriate Rescue Units (ambulances, fire brigade, police).

The specification for the development of the "accident reconstruction procedure" has been done consulting all the relevant parties involved in rescue operations (medical and technical support, traffic management companies, assurance companies).

The control centre hosts the "Triage module" which is in charge of the accident reconstruction in medical terms. Input to this sub-system can be split in three main categories:

- Biomedical parameters linked to each passenger;
- Mechanical parameters derived from the vehicle;
- Biomedical parameters derived from mechanical sensors: seat belt usage, ejection from seat and body motion derived from image processing algorithms.

These parameters are fed into the accident reconstruction process. The input for the DSS provides, for each passenger in the car, the following information:

- The injury severity score (ISS);
- The urgency to get medical care (US);
- Triage ranking (TR), which is a sorted list taking into account the urgency for medical care of every passenger in every car involved in the accident.

Together with the rank position, information on vehicle and position inside the vehicle is attached so the physicians know exactly where the priority is when they reach the accident site.

Moreover, these three scores are components of a greater structure named "Medical Accident Report" that provide the medical operator with the full set of descriptors resulting from the Triage subsystem.

The 'Digital Map' box shall encapsulate functions to manage the digital geographical map, which is separate to the one used in the Road management system. Geo-location of the accident and proper display in a digital map has been identified as a major added-value of the AIDER system.

Integrated antenna

In order to guarantee all the AIDER system functionalities (deriving from the connection with communications networks) the APU integrates some communication modules, whose function is to provide the APU with COSPAS-SARSAT satellite networks, with GPS satellite beacons and with GSM/GPRS networks. These modules need of suitable antennas able to provide an efficient coupling with the electromagnetic fields of the involved communication systems.

At this purpose a customized integrated antenna has been developed, operating in the following frequency bands:

- 406.015 - 406.035 MHz (COSPAS-SARSAT)
- 880 - 960 MHz (GSM "old")
- 1574.4 - 1576.4 MHz (GPS L1 Band)
- 1710 - 1990 MHz (GPRS)

In the development of all the modules automotive specification have been considered.

Video compression algorithm

Among its capabilities, the APU is capable to capture video of the internal and surroundings scenes. This capability supports two major added values of the AIDER system:

- The capability to transmit video clips of the vehicle's internal and surroundings scenes to the rescue centre;

- The capability to record the on-board and frontal scenario before and during the accident.

Due to the limited bandwidth of the communication link the video has to be compressed before it is sent to Control Centre. The compression algorithm developed is based on MPEG-4 standard and is characterized by some advanced scalability features. In particular, the idea is to make possible for the operator at the rescue centre to flexibly adjust the quality and resolution of the received video taking into account both the needed level of detail and the maximum acceptable time for transmission.

To achieve this goal, three main levels of scalability are introduced:

- Temporal scalability: the video is initially transmitted at a low frame rate in order to achieve in short time a preliminary view of the scene. A higher rate can be requested by the operator even for a limited time interval (e.g., to gain a better view of the instant of the impact). This would not require the retransmission of the entire time interval, but just the transmission of additional information.
- Spatial (quality) scalability: the video is initially transmitted at full speed, but at a lower quality (using higher quantization parameters or lower resolution). Based on this preview, the operator can ask retransmission at higher quality of a time-range of the clip. Again, this just implies the transmission of additional information only.
- RoI scalability: In this last case, based on the observation of a static frame (e.g., the first frame of the recorder sequence), the operator can decide that a particular area of the scene is characterized by a higher importance (Region of Interest, or RoI). The operator can then select the requested region, within which the encoder will produce a more accurate reconstruction.

4.2 The demonstrator

Among project outcomes is the equipment of a complete AIDER chain, meaning:

- Vehicle prototype
- Control centre
- Integration of AIDER features in Road Control centre
- Development of the integrated prototype antenna

Figure 2 - AIDER Vehicle demonstrator and AIDER vehicle 360 degree camera + IR illuminator

Figure 3 - AIDER integrated antenna and AIDER PROCESSING UNIT (APU)

Figure 4 – AIDER integration in Sinelec road control centre

4.3 System technical assessment

A specific activity has been dedicated to the AIDER technical system evaluation.
The tests are divided into two phases, aimed to verify the system performance under technical and operational requirements identified during the system definition and development phase. After these tests the system has been considered ready for the final demonstration.

The first test phase considered the AIDER demonstrator vehicle components separately and it has been structured into an on-lab technical evaluation of the system components and crash tests. The tests of the on-lab evaluation check the correct function of the components.
The second test phase consisted of tests in a real environment. These test results checked that the whole AIDER chain was correctly functioning. Two scenarios have been considered in order to validate the correct data transfer from vehicle to CC, using the two communication channel and evaluate the false, missing and correct alarm rates.
A third scenario is related to the CC and evaluates the performance of the decision support system. After the successful closure of this section, the APU function is tested with regards to the crash robustness.

During the testing and evaluation period of the AIDER system all the Hardware & Software modules constituted that the "Overall Chain AIDER System" were up and running correctly:

- the integrated antenna tests gave positive results.
- APU crash test proved its crash robustness.
- Backup Satellite Channel tests gave a positive result in sense of reliable automatic switch to the SARSAT/COSPAS backup communication system in case of GSM/GPRS coverage network failure.

MCC (Medical Control Centre), RCC (Road Control Centre) and DSS (Decision Support System) demonstrate reliability of information assured to the operators. DSS gives quickly to the operators the suggestions for the operations with few clicks to execute in case of an incident.

The execution of a series of real tests around Orbassano-Turin motorway area confirmed the off-line test result outputs.
Within the project an analysis of the CC-operators', car drivers (users'), Police forces and Fire Brigades/Paramedics attitude has been performed with candidates from Italy, Spain, Austria and Germany with general positive attitudes towards an AIDER system.
During the evaluation period the "global AIDER system" did not present a meaningful number of "Run Time errors" and it can be stated that the system is stable. In case of "error" a parallel debug of hardware and software component was executed and "bug" was corrected.

5 COST BENEFIT ANALYSIS

AIDER project ended with the implementation of a complete prototype architecture in order to enable the testing and validation phases. The system has been validated in terms of *technical assessment* to confirm that the adopted approach is correct in terms of concept definition through a step by step evaluation of all the Rescue Chain.

The investments justification for the introduction of technological solution on the market is only supported by the quantification of society benefits and added values. For this reason in parallel to the technical assessment, the validation phase included the Socio Economic Analysis concerning the identification of benefits, gain and losses for all members of society, deriving of the implementation of a specific solution in comparison with the existing situation. The assessment estimation considers the balance of the benefits perceived versus the investments required for the implementation of the AIDER solution.

The socio economic analysis has been done taking into account the following aspects.

In relation to AIDER features three scenarios have been identified in order to calculate *AIDER market penetration* and related probabilities to have AIDER equipped vehicles in an accident (*AIDER performance*).

In order to estimate the main benefits introduced by AIDER, a complete analysis of European accidents statistics has been done. This highlights that while the accidents seems to decrease in a continuative way only from 1999, the fatalities reduced from about 46.000 in 1992 to 38.000 in 2002, but it is still high. With respect to the total of involved persons in road accident 97,75% are injured and the remaining 2,25% killed. Looking more in accident statistic it is possible to see that 72% of road accident happens in rural area where, in case of “traditional” emergency call it is difficult for the rescue operator to identify accident location.

In the analysis it has also been noticed that the importance to start as soon as possible the medical intervention to the injured person represent a crucial factor for survival or death. This important time frame is also called the "**Golden hour”.** In order to respect the so called “**Golden hour principle**” the availability of detailed information concernign accident typology and location represent a key factor. It has been demonstrated that AIDER features satisfys this requirements contribuiting to the reduction of time of intervention and so containing the accident severity.

Main AIDER system impact consists in the rescue time reduction, with consequences in fatalities and severe injuries reduction. In particular, AIDER system enables to reset to zero time between crash and SOS call generation and reduces times for accident location, accident data collection and rescue configuration. Consequently it allows saving about 7 minutes for urban accidents and 13 for extra-urban ones.

The relation between AIDER functionalities and their impact it is modelled accordingly to the scheme reported in figure 5, which guided the calculation of benefits and costs.
In particular have been highlighted:

- the importance of accident location automatic identification and the notable reduction of accident detection time due to the automatic SOS call generation;
- the rescue time reduction with implication in the fastest involvement of rescue means and consequently the mitigation of injury severity. Moreover a control of the rescue intervention introduce benefits also in traffic avoiding traffic jam;
- the rescue efficiency improvement in terms of cost reduction due to the involve of appropriate rescue fleet avoiding underestimation or overestimation of accident severity;
- the availability of accident dynamics parameter due to AIDER black box features useful also for insurance purpose.

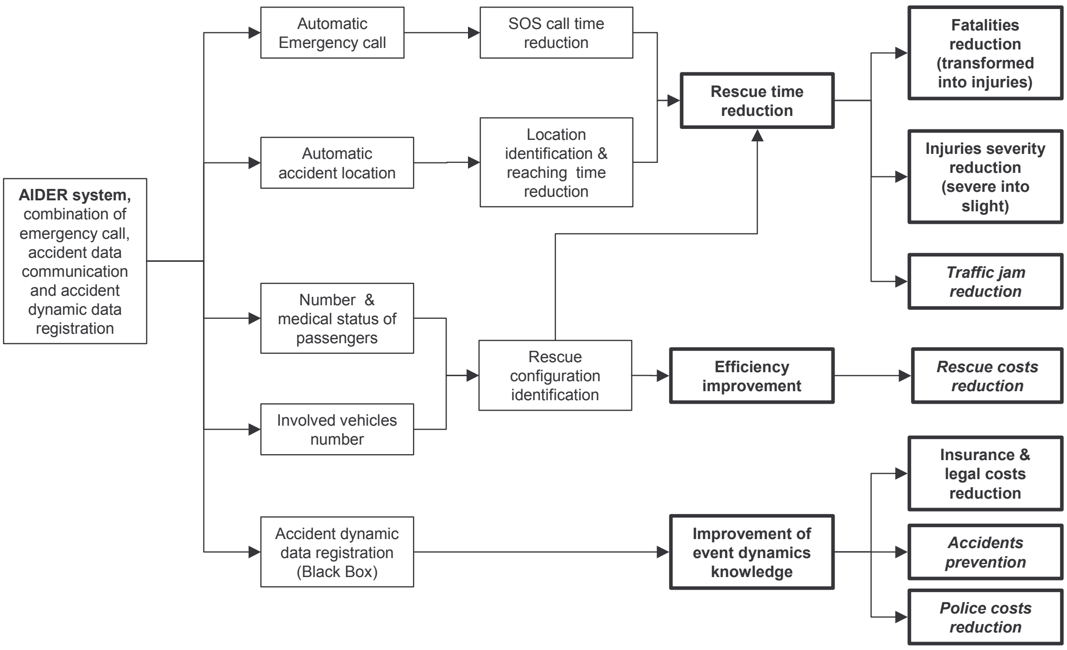

Figure 5 - AIDER impact modelling

As represented in figure 6 the actual rescue chain process time is reduced with the introduction of AIDER system. Secondly, AIDER improves the rescue process efficiency as it supports Rescue units configuration avoiding extra-costs due to over-estimations of necessary units.

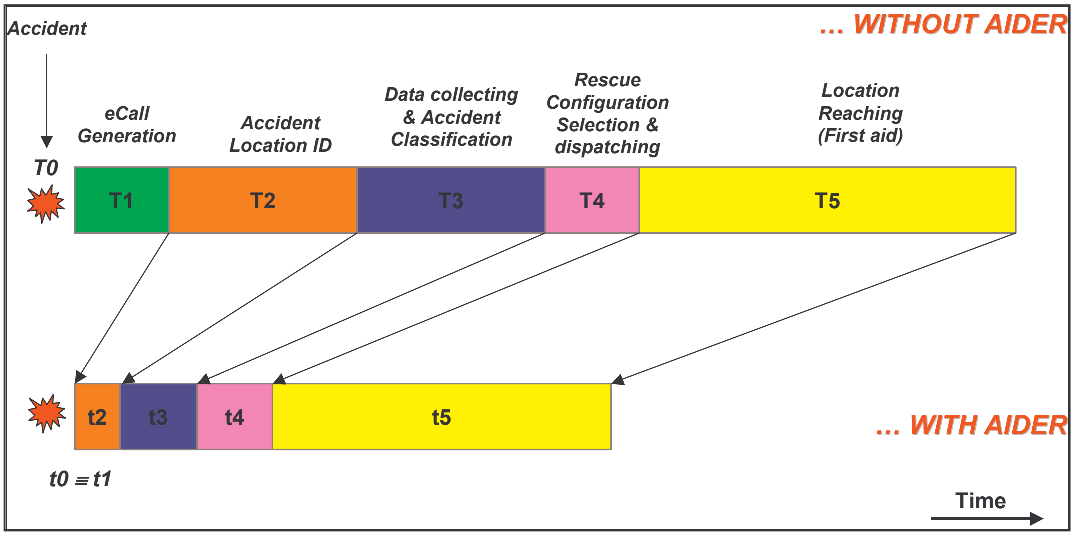

Figure 6 – Rescue process time compared with AIDER introduction

Benefits coming from above indicated AIDER impacts have been compared to the global system costs (both investments and operating ones) in order to obtain an indicator of the system worthiness: the Benefit-Cost Difference (D). This difference has been calculated considering AIDER implementation at a European level. The estimated benefit-cost difference continues to be positive when different values for uncertain parameters are tested (by means of a sensitivity analysis).

6 LINK TO EUROPEAN ENVIRONMENT

Within the objective to reduce the number of accident and to reduce the severity of accident consequences, the thematic area related to the eCall is considered of high priority and specific activity within EC are leaded so to approach to the definition of a harmonized European emergency service chain.

The main objective of AIDER project is the optimisation of rescue procedure. In this sense the above presented results approached to a concrete solution making use of specific existing standard and being a balance among technical constraints, standards constraint, user needs and specific stakeholders requirements.

Within this introduction he project delivered a complete eCall AIDER architecture in which the following points have been considered and technically implemented:

- In vehicle system in charge to monitor vehicle's status, to store vehicles parameters as black box, to identify accident and start an automatic SOS call towards the rescue CC;
- Control Centre designed to be able to manage the voice and data link with the in vehicle system, to process the received data and to identify accident severity;
- The communication link. Towards communication link some specific technical assumptions (in terms of communication protocol to adopt and bearer type) have been done in order to reach a concrete implemented solution. A specific description is available in deliverables D4.1

Within the "eSafety" environment, the eCall Driving Group which is working on an integrated strategy for Pan-European emergency services, related to vehicle telematic systems. The working group achieved the definition of a set of main requirements which represents the starting point for the establishment of such an architecture.

The main concepts, identified by the eCall driving Group, related to the service chain are the following:

- Use of 112 for both manual and automatically emergency calls generated by IVS (eCalls);
- Transmission of a defined Minimum set of Data (MSD) from the vehicle to the PSAP using the 112 infrastructure;
- Use a common and standardized communication protocol;
- Obtain consensus on the way to deploy eCall through a Memorandum of Understanding (MoU).

Emergency services are based on location-enhancement and on the implementation of E-112. Important is the provision of more accurate location information and additional safety information.

In the table 1 the comparison of eCall Working Group architecture and AIDER architecture is reported as a summary of the differences proposed by the two architectures and highlighting the main added values introduced.

In the table with symbol "√ " it is indicated where the implementation accomplishes to the mentioned functionality. It is possible to see that a different approach has been adopted in AIDER for the "communication protocol" and "strategy for the involvement of telecom operator and implementation of PSAP". Some features like "video transmission", "accident dynamics reconstruction" and "integration of AIDER in Road Control Centre" have not yet been considered by the eCall Working Group. While the availability of the back up communication bearer (e.g. satellite communication link as back up of GSM) is considered as an optional for the eCall Working Group.

Table 1 – AIDER versus European Ecall features

FEATURES	EUROPEAN eCall solution	AIDER solution	NOTES
IVS – eCall initiator	√	√	Both the considered architecture are based on the presence of the in vehicle system responsible to initiate the eCall and to manage the voice and data link towards the rescue control centre. The requirements coming from the eCall Driving Group are not so tight concerning the IVS. It is especially stressed the fact that the IVS shall not be expensive and shall be ease to be integrated in different classes of vehicles so to contribute to a large market penetration of the system. AIDER system satisfies the requirements even if its capabilities are more advanced than the required one. A subset of the AIDER in vehicle system is fully compliant to the European eCall solution. The full AIDER IVS offers an improved service and can be extended to other telematic applications, on the other hand the complexity will impact on system costs.
GSM main communication bearer	√	√	Both the solutions are based on GSM as the main communication bearer, considering the extension to 3G network as soon as the technology will support it. The communication link includes voice and data exchange.
Back up communication system	**OPTIONAL**	√	Since the eCall is a very demanding service which must be available at any time and everywhere, and the GSM network is not responding to these requirements, the AIDER system integrates a satellite communication module (SARSAT/COSPAS) to be used as a back up solution. Within AIDER this issue has been considered of high priority for a system dedicated to eCall. A different communication strategy and a modification in the data set is requested in case of use of the satellite communication link.
IVS redundancy	√	√	Both the solutions require the adoption of some redundancies for the in vehicle equipment in order to guarantee the task accomplishment in each situation. At least the need of a back up battery, a back up antenna, a strategy for prevention of false call has been identified.

Minimum Set of Data (MSD) and Full Set of Data (FSD)	√	√	Both the considered architectures specified a set of data for the eCall generation. The European eCall solution identified a Minimum Set of Data (MSD) which includes the set of information useful for the events identification. In case of extended service an FDS is considered. Concerning the AIDER solution the data set is quite complete, considering also the availability of video referred to in vehicle scene and all data needed for the accident reconstruction and severity evaluation. The first conclusion is that AIDER set of data is not compliant to the European MSD without adaptation. A more complete analysis reveals that the European MSD is a subset of the AIDER set of data.
Communication protocol	√	**DIFFERENT APPROACH**	As described within this document the European eCall solution is aimed to search and adopt an appropriate standardized communication protocol covering the transport and application layer. Moreover a specific link with ETSI has been establish. The AIDER Concept is based on direct FTP communication between the Vehicle and the AIDER FTP Server located and managed by the Control Centre. All packets are transmitted by FTP as binary files.
PSAP and Telecom Operator involvement	√	**DIFFERENT APPROACH**	In the European eCall architecture the National 112 centre is assumed to be extended to the PSAP. The AIDER architecture includes a Control Centre. The Control Centre functions are the same implemented in the PSAP even if in the project a traditional phone number (not the 112) has been used. In AIDER it has been supposed to have the line always available without taking care of priority and timing. Moreover since the AIDER solution is more complex in terms of IVS features and set of data, the effects are perceived also in the Control Centre architecture which looks more demanding in terms of software application and it is not yet integrated in National 112 centres. The AIDER Control centre is more comparable to a Service Provider.
Road Control Centre	**NOT CONSIDERED**	√	In case of accidents occurred along highways which are managed by a Road Operator within the AIDER solution it has been considered of high importance the integration of the AIDER features in the Road Control Centre (RCC) and the definition of a specific communication link between the PSAP and the RCC for an appropriate management of the traffic condition, for a better identification of accident position along the motorway and for a more efficient routing of rescue vehicle within road traffic. In this sense DATEX protocol has been used. The consideration of this feature can impact consistently on the PSAP architecture. At this purpose a dissemination action will be done towards the RESCUE project (in GST integrated project) with the scope to definitively evaluate the introduction within the European eCall.
Video	**NOT CONSIDERED**	√	The AIDER solution considers of great importance the availability of the video concerning in cabin view and frontal view. This task is completely not included in the European eCall solution.
Accident dynamics reconstruction	**NOT CONSIDERED**	√	The AIDER solution considers the use of data set available from the vehicle in order to make off line accident dynamics reconstruction, to evaluate passengers' injury severity and possible medical consequences. The AIDER data are also available to evaluate the impact on the insurance reimbursement.

7 FUTURE DEVELOPMENTS

Considering European road scenario it is clear that in the last years the number of vehicles present on the road is increasing enormously. Among some key features concerning road environment, some problems represents daily activity for public administration and involved stakeholders. In particular the number of road accident is still very high (about 1.3 million per year, killing more than 40000 people).

Social and economic aspect are leading the common opinion to increase attention towards these black scenario; in particular some initiatives are starting so to:

- encourage road users to improve their behaviour, in particular through better compliance with the existing legislation, basic and continuous training for private and professional drivers and by pursuing efforts to combat dangerous practices,
- make vehicles safer, in particular through technical harmonisation and support for technical progress; the aspects concerning electronic technologies ("eSafety") will be covered by a forthcoming Commission communication on information and communication technologies for intelligent vehicles".
- improve road infrastructure, in particular by defining best practices and disseminating them at the local level and by eliminating accident black spots.

AIDER is located in this specific scenario and in particular, considering the fact that the availability of real time information is becoming a key factor for the improvement of traffic safety, especially to prevent accidents and in all cases of emergencies.
The state of the art in terms of emergency call service in Europe depicts a quite complex scenario, mainly characterized by the following items:

- Each country adopt a different dedicated number to deal in case of emergency (112, 118, 15999, etc). This is cause of disorientation when a foreign user has to deal with this kind of service. To overcome this problem since July 2003 European Commission defined a directive in order to define a unified emergency call number: 112 (directive 91/396/CE). It is now competence of each country the actuation. Moreover in directive 91/396/CE it is also highlighted the importance of “accident localization”.
- At the moment the call taken into account are voice call. The user dials the dedicated number and has the possibility to provide to operator all the information regarding the emergency happened. Often due to the user panic feeling it is difficult to provide detailed information about incident location or emergency severity. In particular this item is highlighted speaking about road accident. The presence of a telematic system in the

vehicle can make the operation easier and powerful. However actual public centres are not able to manage data reception from a vehicle.

- The presence of private service provider let possible the generation of telematic emergency call (data and voice). Already now most vehicle manufacturers, as well as telematics service providers, are providing a proprietary vehicle emergency call service (E-Call). However, there is no common technical solution, services do not (generally) offer roaming when abroad, and procedures and arrangements further down the service chain – to the network operator, then to an emergency call centre and finally to the emergency service itself – vary greatly from country to country.

AIDER achievements are projected towards the depicted scenario in particular highlighting two aspects:

1. accident not only occur due to vehicle failure and road condition, but often due to un-correct driver behaviour. The availability of a black box on board aimed to record vehicle's data and accident profile is of essential importance for the reconstruction of mission profile and responsibility identification. In this sense it is possible to locate the kernel of AIDER system;
2. when accident happens, only by a voice call it is always more difficult to provide to the control centre operator precise indication about accident's location and typology, nor indication concerning medical status of passenger, so to le the operator to better identify accident severity and optimise rescue intervention;

The achievements obtained within AIDER project goes in the mentioned direction and so the consortium is aimed to push the integration of such a system in national control centre via a sensitisation and dissemination if technological concept.

Concerning the in vehicle system a dedicated activity towards industrialization is needed not only aimed to optimised algorithms and hardware structure but it is needed the establishment of a cooperation between car maker and system supplier so to design a platform being suitable in the car and compliant with current architecture. In parallel the intent to work towards the establishment not only of a private service but to a public emergency service put some tie which needs to be faced with attention.

Some AIDER achievements such as the video management, can be extended in other environment, such has inside ambulance for remote diagnosis purpose. In this sense AIDER concept will be continue in other R&D initiative.

This is the case of RESCUE sub-project of GST, integrated project within 6th framework programme. In this sense synergies will be carried on so to use the obtained results as starting point for new initiatives.

8 CONCLUSIONS

The present report was aimed to give a complete overview about IADER project.
In this sense have been presented the scenario in which the project is located and the project aim itself.
Consequently have been presented the work plan and the main technical achievements reached.
Among project results a complete AIDER chain have been implemented and it is now available for system evaluation and testing, but also for demonstrative purpose, useful for the future exploitation activities.
Since AIDER system is still at prototypal phase, has been evaluated which could be the market introduction of the system and which can be the involved actors through a business plan analysis.
The realization of the system required the know how and experience from many companies, belonging to different sectors. In the document has been presented the consortium and each partner's role.

Within the document there are reference to technical issues, which are deeply reported in specific document. For this purpose a list of all available deliverables have been provided. In any case when necessary, special remarks are included in the text.

9 ANNEX I

9.1 Deliverables and other outputs

The output of AIDER project are classified in the following natures: report and prototypes documenting the performed activity and the technical achievements.

In addition a number of papers have been submitted in order to disseminate the project results.

Here are reported all available outputs.

Table 2 – Deliverable list

Number	Title	Nature[1]	Security	Status
D01.1	Project presentation	R	Pub	Submitted
D06.8	WWW site for AIDER project presentation	O	Pub.	Submitted
D02.1	State-of-the-art and Accident Analysis for the AIDER Concept definition	R	Pub.	Submitted
D06.4	Dissemination and Use Plan	R	Rest..	Submitted
D02.2	System operational requirements	R	Pub.	Submitted
D03.1	On-board System specification and architecture	R	Rest	Submitted
D03.2	Control Centre System specification and architecture	R	Rest	Submitted
D03.3	Communication Specification	R	Rest	Submitted
D05.1	Draft evaluation Plan	R	Pub.	Submitted
D05.2	Evaluation Plan	R	Pub.	Submitted
D04.1	AIDER System description	R	Pub.	Submitted
D04.2	Prototype AIDER System	D	Rest	Available
D05.3	On lab technical evaluation results	R	Rest	Submitted
D05.4	System test results	R	Rest	Submitted
D06.1	Cost/Benefit analysis	R	Pub.	Submitted
D06.2	Legal and ethical implication of the AIDER system and Risk Analysis	R	Pub.	Submitted

[1] R = Report; P = Prototype; D = Demonstrator; O = Others.

D06.3	Common standard recommendation	R	Pub.	Submitted
D06.5	Technology Implementation plan	R	Rest.	Submitted
D06.6	Final Report	R	Pub.	Submitted
D06.7	Multimedia project presentation	O	Pub.	Submitted

The following papers have been presented:

- "Accident Information from the Vehicle for Optimisation in Management of Rescue Operations" ; e-Safety Congress in Lyon – September 2002
- "Smart Rescue & Emergency Management: the AIDER project" ITS Congress – October 2002
- "Assessment of the GA-based adaptive array control strategy: the case of stochastic life-time co-channel interferences," Microwave and Optical Technology Letters, vol. 37, no. 3, pp. 198-201 – May 2003
- "Adaptive antenna array control in presence of interfering signals with stochastic arrivals – Assessment of a GA-based procedure," IEEE Transactions on Wireless Communication. – May 2003
- "Vehicle and infrastructure equipment for emergency call management efficiency improvement" 10th ITS Congress in Madrid – November 2003
- "AIDER - The approach toward a pan European Accident Management System" paper presented to ITS congress, Budapest 2004
- Cristina Costa, Francesco G.B. De Natale, Fabrizio Granelli, "Quality Evaluation and Non-Uniform Compression of Geometrically Distorted Images Using the Quadtree Distortion Map (QDM)", submitted to EURASIP Int. Journal on Applications in Signal Processing
- Massa, M. Donelli, F. De Natale, S. Caorsi, A. Lommi, "Planar antenna array control with genetic algorithms and adaptive array theory", IEEE Trans. on Antennas and Propagation.
- G. Berlanda, N. Conci, C. Sacchi, F.G.B. De Natale, "Multicarrier Code Division Multiplexing for Efficient Transmission of Multi-Layered MPEG-4 Video Signals in Mobile Satellite Applications, Proc. 7th Intl. Symposium on Wireless Personal Multimedia Communications" (WPMC'04).
- M. Donelli, S. Caorsi, F. De Natale, D. Franceschini, and A. Massa, "A versatile enhanced genetic algorithm for planar array design," Journal of Electromagnetic Waves and Applications.

10 ANNEX II

10.1 Consortium composition and roles

Partner N°	Organisation name	Country	User/supplier	Main RTD Role in the project
1	CRF Società Consortile per Azioni	I	Car manufacturer	• Project Management • On-vehicle system architecture specification • Development of interface towards vehicle's CAN bus • Equipment of demonstrator vehicle and integration of AIDER in the present vehicle architecture • Coordination of complete system integration and testing • Dissemination of results and analysis of business plan and market approach
2	DaimlerChrysler AG	D	Car manufacturer	• On-vehicle system architecture specification • Algorithm implementation for data processing and data fusion for crash severity evaluation at vehicle level • Exploitation of results
3	IAT-Orantech,	IL	System Engineering	• Quality control • Business Plan • Exploitation and dissemination of results
4	Elbit System Ltd.	IL	System Developer	• On-vehicle system architecture specification • Development of APU (HW and SW) and integration within the communication system and interface with the control centre • Development of video algorithm for the compression of on board video
5	Tadiran Spectralink Ltd.	IL	Communication manufacturer	• Development of SW and HW on-board communication system
6	RAMOT (Tel Aviv) University	IL	University	• Contribution in the first year of the project to the specification of the integrated antenna. • 2^{ND} project year: resignation

7	GMV Sistemas S.A.	E	System Engineering	• Data processing for "accident reconstruction", at Control Center level • SW interface for communication system at Control Center level. • Design and development of the Control Centre and integration with the Road Control Centre
8	Università degli Studi di Trento	I	University	• Development of SW tools for video coding • Development of the integrated antenna
9	RWTH - IKA	D	University	• Test plan definition • System evaluation through tests in simulated scenarios and real crash tests
10	SINELEC S.p.A	I	Private Industry	• Equipment of Control Center • Development of "decision support" SW at Control Center level • System evaluation and demonstration in real motorway scenario.
11	ISM-Austria, Institute of Applied Sciences in Medicine GmbH	A	Medical Institute	• Signal and data processing for accident severity evaluation based on biomedical sensors