e-NOTIFY: A Proposal to Improve the Responsiveness of Emergency Services

Francisco J. Martinez
University of Zaragoza, Spain
Email: f.martinez@unizar.es

Juan-Carlos Cano, Carlos T. Calafate, Pietro Manzoni
Universidad Politécnica de Valencia, Spain
Email: {jucano, calafate, pmanzoni}@disca.upv.es

Jose M. Barrios
Applus+IDIADA, Spain
Email: jmbarrios@idiada.com

***Abstract*—This work presents e-NOTIFY, a novel proposal designed to improve the responsiveness of emergency services by reducing the time required to rescue the passengers involved in a car accident, and automatic managing to optimize the medical and rescue resources needed. e-NOTIFY does not concentrate on reducing the number of accidents, but rather focuses on improving the rescue procedures. To this end, once the accident has occurred, e-NOTIFY tries to automatically and efficiently manage the emergency resources, making it possible to predict the injury severity of occupants, and thus adapt the required rescue resources and reducing the response time of the emergency services.**

***Keywords*-Traffic Safety; Emergency Services; Vehicular ad hoc Networks; Inter-Vehicular Communication**

I. Introduction

The number of vehicles on the road is constantly increasing, making traffic density higher and increasing the requirements of drivers' attention. Car accidents represent a serious problem all around the world. In 2007 alone, 40,000 people were killed in Europe and more than 1.2 million were severely injured. However, some studies conclude that a faster response of the emergency services could reduce these numbers by 11% of deaths and 12% the number of injured.

The European Commission is funding several projects under the so-called eSafety initiative [1] launched in 2002 in order to halve the number of road fatalities by 2010 [2]. This has promoted several efforts toward new safety systems among which Cooperative Systems. Communications are now considered necessary and will play an increasing role in the Intelligent Transportation Systems (ITS) area. Most ITS applications such as road safety, fleet management and navigation, will rely on data exchanged between the vehicle and the roadside infrastructure (V2I) or between vehicles (V2V). In this paper we present e-NOTIFY, a novel proposal designed to improve the chances of survival for passengers involved in car accidents by reducing the response time of rescue teams and optimizing automatically the medical and rescue resources needed. This proposal is not concentrated on reducing the number of accidents, focusing instead on post-collision strategies to optimize the rescue procedures. Once the accident has occurred, it is crucial to efficiently manage the emergency resources. A faster and more efficient rescue increases the chances of recovery for injured people. This paper is organized as follows: Section II presents the motivation of this paper. Section III presents our proposed architecture called e-NOTIFY. Finally, Section IV presents some concluding remarks.

II. Motivation

Fast and efficient rescue operations after car accidents increase the probability of survival for injured occupants significantly. The so-called Golden Hour is a commonly used medical term to characterize the urgent need for the care of trauma patients. This term implies that morbidity and mortality are affected if care is not instituted within the first hour after injury. For a sustainable reduction of time, two major steps must be addressed: (i) fast and more accurate notification of the accident to the next Public Safety Answering Point (PSAP), and (ii) fast and effective evacuation of occupants which are trapped inside a vehicle.

Technical rescue personnel usually faces problems such as (i) not knowing the distribution of rescue critical materials in the vehicle's structure and (ii) not knowing the most efficient techniques for dealing with these materials. Based on simulation and testing, new and effective rescue tools and strategies are being developed to adequately handle the demands of modern vehicles. Moreover, different cutting procedures and evacuation techniques will be examined with numerical simulation. The most efficient rescue strategies will then be made public on a web-based information platform where rescue crews can retrieve information about rescue operations either for training or on-site using mobile devices. Nowadays, information about possible ways to extricate the vehicle's occupants in certain accident situations is not provided. The used extrication technique is only based on the experience and equipment of the technical rescue staff.

The main objective of the proposed system is to define and design a prototype for an integrated infrastructure to detect and send alert messages to emergency services when road accidents occur, taking advantage of the available communication technologies such as 802.11p (VANETs) and telephony cellular networks, making it possible to build a huge database with technical rescue instructions and medical information helpful to rescue workers, thus providing an invaluable source of information for the extrication of people from crashed vehicles.

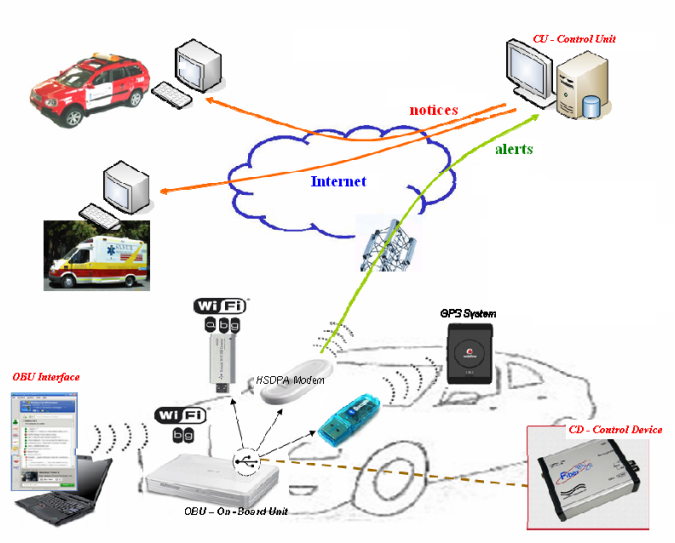

Figure 1. Devices and technologies involved in the proposed system.

III. E-NOTIFY

In this section we introduce the e-NOTIFY architecture, describing how it operates, as well as the technologies involved. Figure 1 shows the devices required and the technologies involved in the proposed system. A core element of our system is Internet, since it allows the communication between vehicles (at bottom), the Control Unit (right top), and the different rescue entities (left top). In our proposed system it is very important to consider and correctly define the On-board Unit (OBU) that receives all the information from the sensors installed in the vehicle, and determines how and when this information should be sent to the Control Unit (CU) in order to warn the emergency services. This device must be technically and economically feasible. Moreover, this system must be open to future software updates. Although the design of the hardware to be included in vehicles initially consisted of special purpose systems, this trend is shifting towards more general purpose systems due to the inclusion of new services. The OBU has to include communication interfaces to connect to the communications system.

Rescue services currently do not have any vehicle-specific safety information available at the scene of the accident. The electronic systems currently provide standardized information in a consistent format for all manufacturers. However, the vehicle selection should be improved so that rescue staff can select the correct vehicle model.

Figure 2 shows the SOS Packet Format. This information can be obtained by the embedded sensors. Only 36 bytes will be sent by each crashed vehicle. All these data shall be automatically processed by the Control Unit (CU) to decide the resources needed to correctly control and manage the accident. The CU will compare the received data with

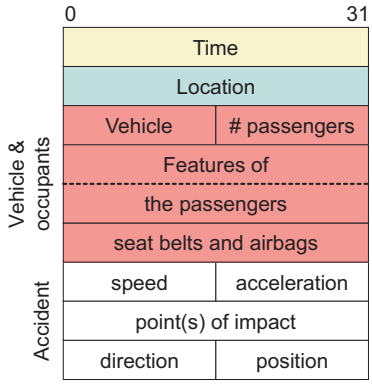

Figure 2. SOS Packet Format in the proposed system.

previous data collected in a database of accidents, making it possible to predict the injury severity of occupants, and thus adapt the rescue services sent to the accident zone. Based on preliminary results obtained from our experiments, we estimate a reduction of the response time of about 20%.

IV. Conclusions and Future Work

The overall goal of this work was to present a novel architecture specially designed for post-collision rescue. This architecture allows for (i) direct communication among the vehicles involved in the accident, (ii) automatic delivery of a data file to the Control Unit that contains important information about the accident, and (iii) an automatic and preliminary assessment of damages based on the received information and a database of accidents, adapting the rescue resources needed. This system has the advantage of being fully integrated into vehicles and builds upon the goals of other similar systems such as eCall.

Once the system has been defined, future work includes the development of a prototype to be installed in vehicles. This development will be carried out by the engineers of Passive Safety, Active Safety and Electronics departments of Applus+Idiada with the collaboration of the GRC research group from the Technical University of Valencia.

V. Acknowledgment

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