

ECall Service Design and Implementation in a Windows CE Embedded System

The work developed in this thesis addressed the implementation of a service, oriented to road safety, named Emergency Call (eCall) within a prototype designed as a result of the European project GOLDEN-ICE. The purpose of the service is to improve the assistance to the driver, especially in case of an accident. The project is founded by the European Commission within the VII Framework Programme of Research and Development, and started in 2009. It is expected to be completed by 2014.

The eCall application is implemented in the GOLDEN-ICE prototype board. Such a board is placed inside the car and monitors the car behaviour, cross-checking some important data like the Global Positioning System (GPS) position, the airbag activation or other data that might prove a violent impact.

As a result of a detected event, or due to of a manual request by the user, the application must connect the user with an operations center. This should speed-up and optimizes the rescue operations. The service is divided in two steps. The first step is to establish the link and send some primary information like the last GPS position, vehicle type and passengers number to the operation center. The following step is to open a direct audio link with an operator, so that the user can confirm or not the rescue necessity thus asking for help. The first step is very important and it must be automatic, especially in case nobody of the passengers can communicate with the operator. In this case, the application should have already sent the information to the operator that can send a rescue unit in the place of the accident. The information is also more accurate, because it is acquired with the GPS receiver.

In this project are involved many companies, and since the start of the project they found many problems to realize it in European scale. Really, the greater problem is to create a standard protocol for the service. For example, the protocol proposed by the European Commission, indicates that the telephone number for the operations center must be the same in all countries of European Union, namely should be the emergency number 112. In Italy this number is already occupied; in fact this number is used to contact the police. This small problem and many others, block the creating process of the eCall service.

As a result of these obstacles, some companies, like BMW, FIAT, Volvo, created their own solutions. These solutions are based on the general protocol, but removed the problems of the standardization doing choices that are suitable only for some countries of European Union, in which have activated the service.

Other problems are linked to more technical aspects like, for example, the choice of the wireless communication with the operations center. The owners solutions mentioned above work through the use of Short Message Service (SMS) or General packet radio service (GPRS) that are different by the specifics of the European Union.

We can see that the eCall project involves different technologies. In fact, it is used a GPS receiver, a GSM (Global System for Mobile Communications) modem and very important is also the reader of the CAN. The application must be linked to the CAN, so that it can obtain important information for the detection of an accident or failure (airbag activation, braking, etc...). The problems mentioned above, are also linked to the necessity of a correct cooperation between these different technologies. Mostly it is important to find protocols that are compatible in every country of the European Union.

When the system will be active and diffuse, the application should be structured so that are possible to add new telematics services for the tracking or traffic information. One of the task is to model the system so that, after, is easily extensible with feature development.

The application described in this document, is an example and an attempt of implementation of the eCall service. The software is installed on a board with operative system, *Windows CE 6.0 R3*. It has also a small screen, so is possible to add a graphical interface for the application. The interface is created with *Silverlight for embedded* and the core of application is written in *C++*. In the board is integrated a GPS receiver, a GSM Modem and a device to read the CAN line. For each device, was implemented the driver to use it.

The structure of this application was created in order to be easily adaptable. The initial data, are sent in a package, called Minimum Set of Data (MSD), through the Protocol Data Unit (PDU) message that is a service, offered by the GSM protocol, that allows to send binary messages. Its structure allows changing the MSD transport mode or the mechanisms to contact the central station, thanks to few modifies.

In the system is very important the role of the Public Safety Answer Point (PSAP), that is the operations center, that have to communicate with the vehicle, through the wireless technology available. Has also been designed (but not implemented) a test PSAP so that do own tests. This test software was implemented thanks to *Microsoft Cloud System, Azure*.

The application was also tested thanks to a German PSAP. The structure of the MSD message was implemented according to the required message of the German PSAP.

The eCall system will improve road safety, a big step forward in the protection of the traveller. ECall system can significantly speed up the rescue operation, resulting in more lives saved and more immediate restoration of road traffic. The growing presence of computers in cars and on-board GPS receiver and GSM modem, potentially facilitates the spread of the service.

Also, about the future developments, thanks to the wireless communication line necessary for the eCall service, is possible a bidirectional communication. The vehicles can obtain but also automatically send information about road traffic, about weather, about concentration of pollution creating a system of information exchange that would significantly improve the safety and efficiency on the road.