ANNALS OF THE ORADEA UNIVERSITY
Fascicle of Management and Technological Engineering
ISSUE #1, MAY 2013, http://www.imtuoradea.ro/auo.fmte/

IMPROVING TRAFFIC SAFETY USING MODERN METHODS FOR ACCIDENT DATA COLLECTION

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***Abstract*—**Road safety represents an important objective of the national policies in the European Union (EU) state members. A basic, but very important step in achieving this objective is the accuracy, rapidity and efficiency of the crash data collection systems. This paper proposes a modern system for collecting data from crash sites and presents the steps taken to achieve this system. The advantages of the presented system are notable: rapidity and precision in collecting data significant to elucidate the circumstances and probable causes of the accident, fast and accurate transfer of data from site to a centralized database, facilitated statistical analyses and data comparisons.

***Keywords*—**data collection, modern methods, traffic safety

I. INTRODUCTION

EACH year almost 30000 lives are lost on the European roads. Around 250000 people are reported to be seriously injured [1]. The responsibility is shared between the road users, the vehicle manufacturers, the infrastructure managers, the local and national authorities. Road safety concerns all the citizens, since using the roads and streets is part of every-day life for each individual.

According to recent statistics [2] road fatalities across Europe had decreased by 9% in 2012, this year being the one with the lowest number of people killed in road traffic in EU countries since the first data were collected. Still, a country by country analysis shows that the number of road deaths varies greatly across the EU: if the UK, Sweden, the Netherlands and Denmark are the top road safety performers, Lithuania, Romania, Poland and Greece register the highest number of road fatalities in 2012. Lithuania and Romania even suffered increases of the road deaths numbers [1]. It should be remembered that the road deaths make up only a very small share of the total number of road accidents. It is estimated that for every death on Europe's roads there are 10 serious injuries and 40 more slightly injured [2].

Faced with such terrible figures, the EU elaborated and committed to a long term strategy of abolishing road deaths and serious road traffic injuries. The EU road safety policy emphasizes seven main objectives [1]:

1. education and training;
2. enforcement;
3. safer infrastructure;
4. safer vehicles;
5. use of modern technology;
6. emergency and post injury services;
7. the safety of vulnerable road users.

The EU safety target is mirrored in many of the member states' national road safety strategies. The good figures of 2012 [2] are the result of the initiatives pursued in this direction.

The policy objective directly linked with the subject of our paper is the use of modern technologies for developing systems that improve ~~the~~ road safety. Namely we intend to present a new method for data collection from crash sites, which use electronic devices and tools to increase the efficiency of data gathering process. Data collection is the area where the most states are using technology to improve their crash-data systems. Innovative practices are improving data quality, reducing staff intervention, and expediting data availability within their systems.

II. CRASH DATA COLLECTION SYSTEMS

There is a large variety of road accidents, each of them having specific elements. A scientific classification of these specific elements is realized by the accidentology. The accidentology is a technical subject that studies through scientific methods the road events that result in injuries, taking into consideration all the circumstances and related elements, in order to elaborate efficient solutions for diminishing the number of accidents and their gravity [3]. To achieve its objectives accidentology uses several main data categories, as follows:

- classification of road accidents by number and geographical areas and according some statistical details concerning the vehicles, the human behavior and the environment;
- elaboration of appropriate methodologies to similar

accident risk factors on main roads, touristic regions and rural areas, so as that, taking into consideration their gravity and frequency, to analyze, elaborate and apply the most efficient countermeasures;

- implementation of a unitary methodology of codification, collection and analysis of accidentological information;

Accidentology uses as main source the information provided by the data collected from the crash sites. In order to perform an accurate analysis and to come up with efficient solution to minimize the risks for road events and, consequently, improve traffic safety, it is demanded a highly precise system for collecting crash data. Such a system can be achieved by implementing an electronic method of collecting, managing and analyzing the data.

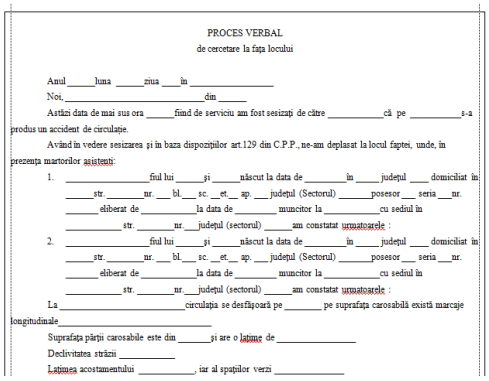
As follows we will present some of the systems for crash data collection that are used at national and international level nowadays.

In Romania the police force uses a standardized written report (Fig. 1.) that comprises the following elements:

- the persons implied in the accident: identification data, injuries resulted, potential risk condition – alcohol, cardiac condition etc.;
- potential witnesses;
- specific data regarding the condition of the road: dimensions, declivity, surface type and any other particularities;
- the weather conditions;
- the identification data of the vehicles implied in the accident;
- the damages resulted from the accident;
- photos and a schematic drawing of the crash site.

After completion, the reports are registered at the police station were all the gathered data are introduced in a computerized database.

In the United States of America there are used different systems for collecting crash data, but all of them follow the same guideline for minimum, standardized data describing motor vehicle crashes and the vehicles, persons, and environments involved, the MMUCC guide - Model Minimum Uniform Crash Criteria (Fig. 2.) [4].



PROCES VERBAL
de cercetare la fața locului

Anul _____luna _____ziua ___în _____
Noi, _____din _____
Astăzi data de mai sus ora _____fiind de serviciu am fost sesizați de către _____că pe _____s-a produs un accident de circulație.
Având în vedere sesizarea și în baza dispozițiilor art.129 din C.P.P., ne-am deplasat la locul faptei, unde, în prezența martorilor asistenți:
1. _____fiul lui _____și _____născut la data de _____în _____județul ___domiciliat în _____str. _____nr. ___bl.___sc. __et.__ ap. ___județul (Sectorul) _____posesor___ seria ___nr. _____eliberat de _____la data de _____muncitor la _____cu sediul în _____str. _____nr.___județul (sectorul) _____am constatat urmatoarele :
2. _____fiul lui _____și _____născut la data de _____în _____județul ___domiciliat în _____str. _____nr. ___bl.___sc. __et.__ ap. ___județul (Sectorul) _____posesor___ seria ___nr. _____eliberat de _____la data de _____muncitor la _____cu sediul în _____str. _____nr.___județul (sectorul) _____am constatat urmatoarele :

La _____circulația se desfășoară pe _____pe suprafața carosabilă există marcaje longitudinale_____
Suprafața părții carosabile este din _____și are o latime de _____
Declivitatea străzii _____
Latimea acostamentului _____, iar al spațiilor verzi _____

Fig. 1. Written report template - Romania

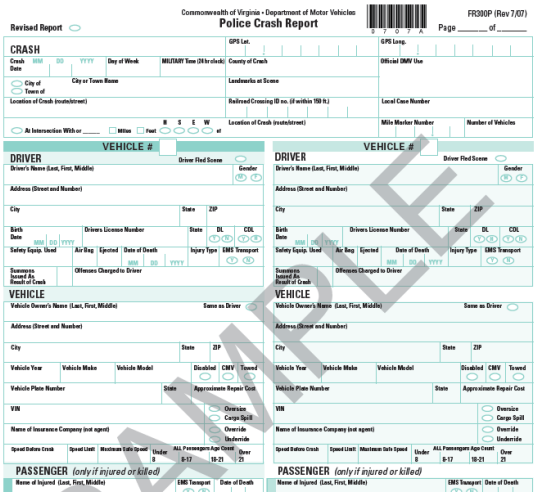


Fig. 2. Written report template - USA

Additional driver information and facility information compose the remaining 24 elements, which are designed to be integrated once the incident is entered into an enterprise database system. Implementing MMUCC has several benefits to agencies responsible for highway safety. MMUCC improves the quality of state and national incident data by forcing data consistency among agencies and enabling data-sharing and analysis among all participants. A data standard also enables software to be developed and shared across multiple agencies, reducing initial costs for system development [4].

Kentucky uses a custom-developed field system for electronic data entry and collection [5]. The field units are equipped with barcode scanners and GPS (Global Positioning System) units to help auto-populate electronic forms from road incidents. The system is live-linked to an enterprise data\base system that contains vehicle and driver data that is automatically transferred to the electronic form, reducing the time needed for data entry and eliminating data-entry errors. This system employs business rules for data validation that enforce data consistency of the entered data. The GPS system automatically inputs the positional location of the incident, allowing spatial display and query downstream. The system records 90 percent of the MMUCC components for 41 percent of all incident records.

Iowa has developed and utilizes the TraCS field data-collection system [6]. The system is field-deployed with an array of barcode scanners, swipe-card readers, digital cameras, GPS units, and touch pads to facilitate automatic and digital data entry. TraCS utilizes the GPS location of the incident to tie-in roadway facility information automatically in addition to automatically populating data elements from vehicle, driver, emergency, and crime data-bases. TraCS has the additional components of a GIS viewer that helps locate intersections and additional area information, a photo-imaging system to directly attach digital photos to an incident report, and electronic diagramming to sketch

incident specifics directly at the scene.

Illinois uses a combination of Iowa's TraCS and a custom-developed, field-based data-entry system [6]. The data-entry system is deployed in vehicles and is equipped with GPS units to determine incident locations. The Illinois system is accompanied by a diagramming tool that electronically details the events with graphic representation. The electronic forms have embedded business rules to ensure data consistency and accuracy in entered data elements. The completed records are transmitted electronically to a centralized data warehouse for retrieval by any authorized user.

These three systems exemplify innovation and efficiency in data collection. While most states (Romania included) are utilizing resources to enter data that was hand-written and later typed, and then entered into an enterprise database system, these three systems are saving critical resources for other programs such as mediation and safety analysis. These time-saving approaches are making incident data available in a matter of hours, as opposed to weeks or months. Also incredibly beneficial is that data are entered once and are validated automatically by consistency rules. These rules dramatically reduce data-entry errors and improve the overall accuracy of the database.

The system we propose situates itself on the technologies trend exemplified by the significant examples presented before.

III. MODERN SYSTEM FOR DATA COLLECTION FROM CRASH SITE

The system for data collection we propose consists of an electronic tablet and a specialized software application. The premises considered in the development of this system are:

- users do not require high computer skills;
- the communication system (Wi-Fi, GPRS – General Packet Radio Service) is working;
- easy to transport and manipulate;
- provides possibility to gather all the data normally collected through the standardized written report;
- GPS for accurate positioning of the crash site;
- real time transmission of the gathered information;
- possibility to draw sketches of the crash site and its location;
- possibility to make photos and video recordings;
- touch screen;

After a thorough analysis of the products from the open market, we decided that a device such as Ee Pad Slider SL 101 will meet the requirement formulated. The tablet has the following specifications [7]:

- Operating System: AndroidTM 3.2;
- Display: 10.1" LED Backlight WXGA (1280x800);
- CPU: NVIDIA® Tegra™ 2;
- Memory:1GB;
- Storage:16GB/32GB;
- Wireless Data Network: WLAN 802.11 b/g/n@2.4GHz;
- Camera: 1.2 MP Front Camera, 5 MP Rear Camera.

The software application was developed using a user friendly web application (Fig. 3.) [8].

Fig. 3. Apps bar application

The application has on the start page (Fig. 4.) five menus that can be easily accessed either on a logical sequence, either each of them separately, randomly. These menus are:

- Form
- Witnesses
- Trace preservation
- Distances
- Contact

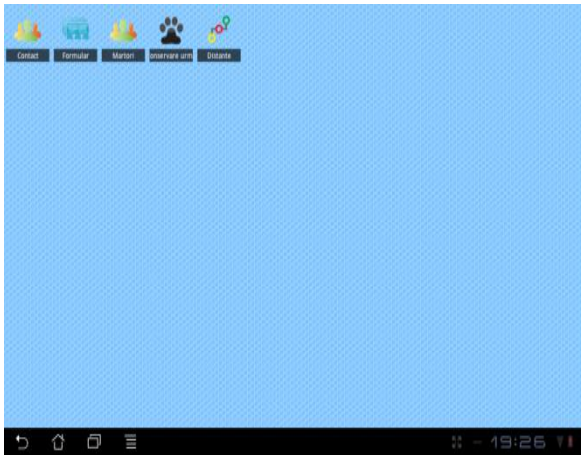


Fig. 4. Application home page

The menus will be presented in a synthetic manner, due to space limitations of the present paper.

In the "Form" menu the user can introduce information like:

- names of the members of the official intervention team (Fig. 5.);
- current date;
- type of accident (e.g. with fatalities, serious injuries, etc.) (Fig. 6.);
- current position of the crash site (Fig. 7.);

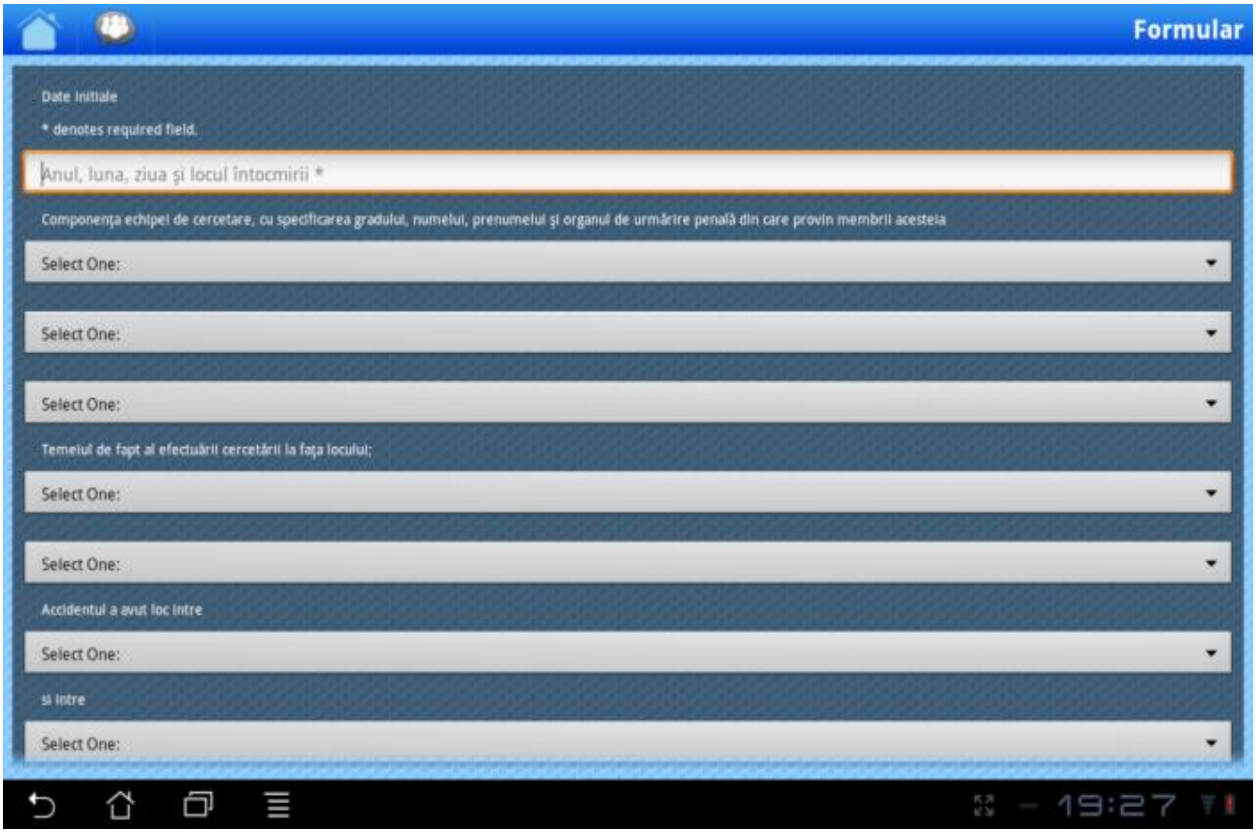


Fig. 5. "Form" menu

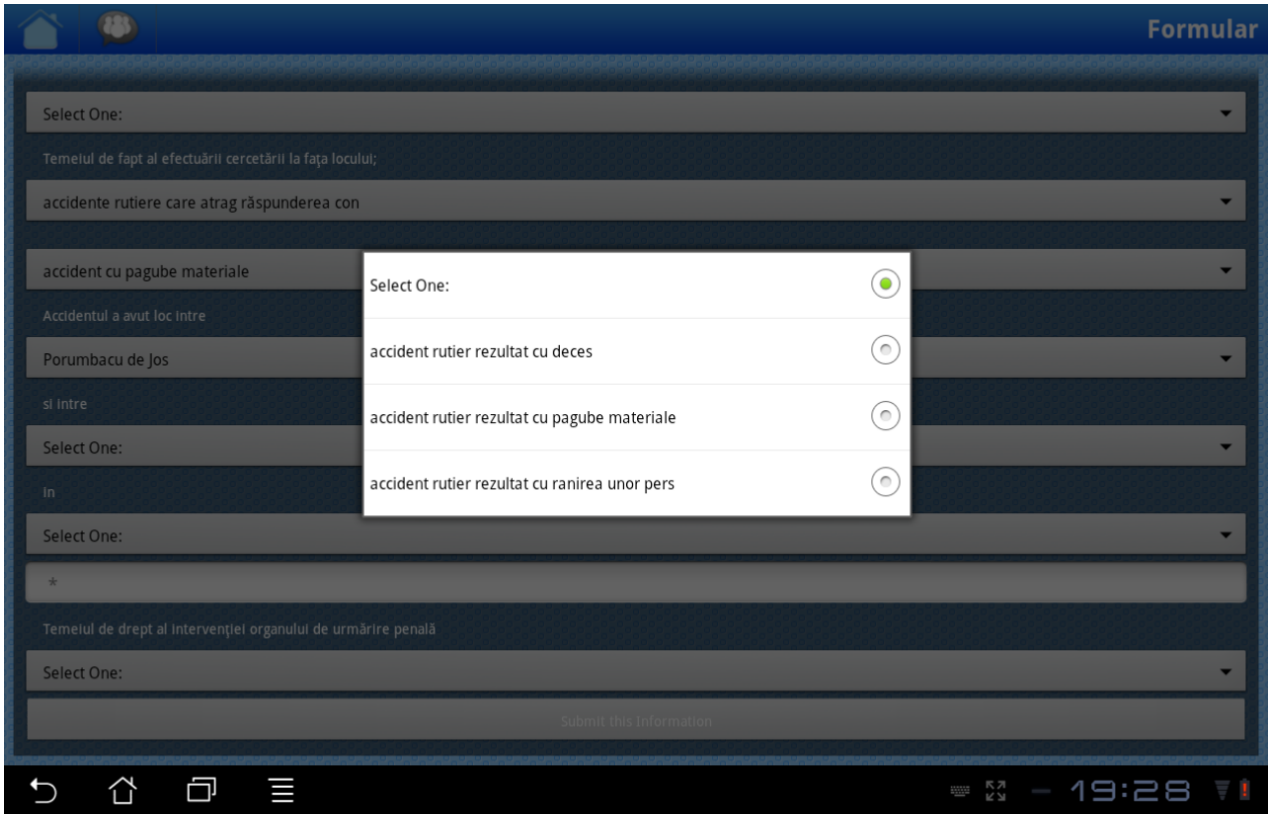


Fig. 6. Type of accident

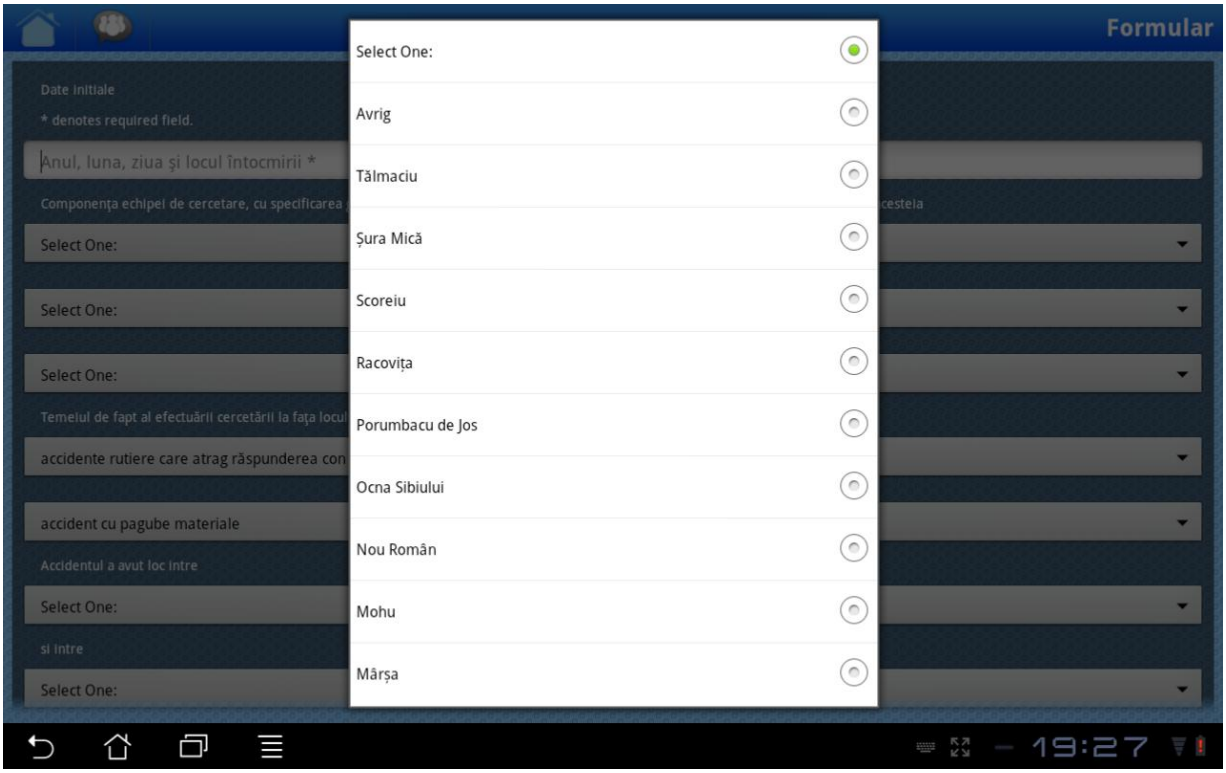


Fig. 7. Current position of the crash site

In "Witnesses" menu (Fig. 8.) are collected data regarding:

- witnesses identification;
- circumstances of the accident.

The menu contains a set of pre-established questions with more potential answers, so as the discussion with the witnesses would develop at a rapid pace and still gather the significant information for analysis.

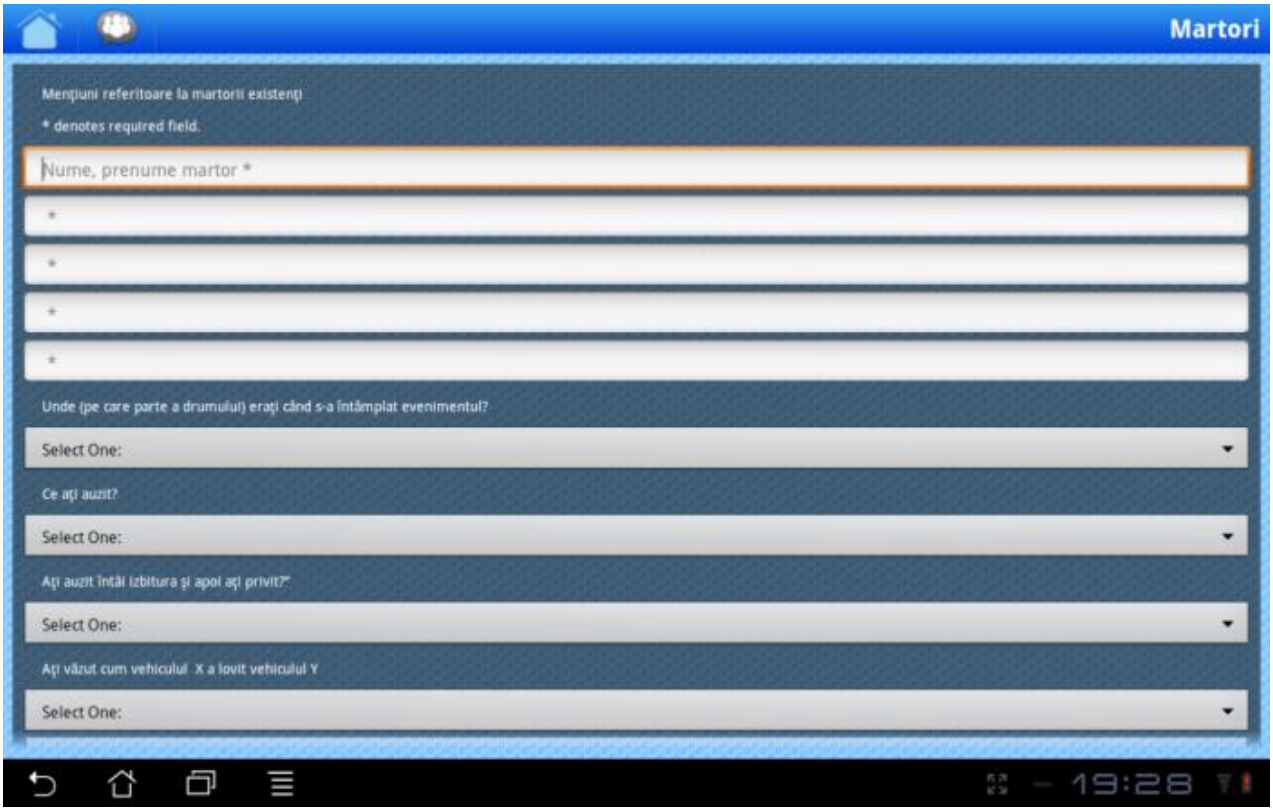


Fig. 8. "Witnesses" page

The menu "Trace preservations" (Fig. 9.) contains checklists of the traces collected from the crash site.

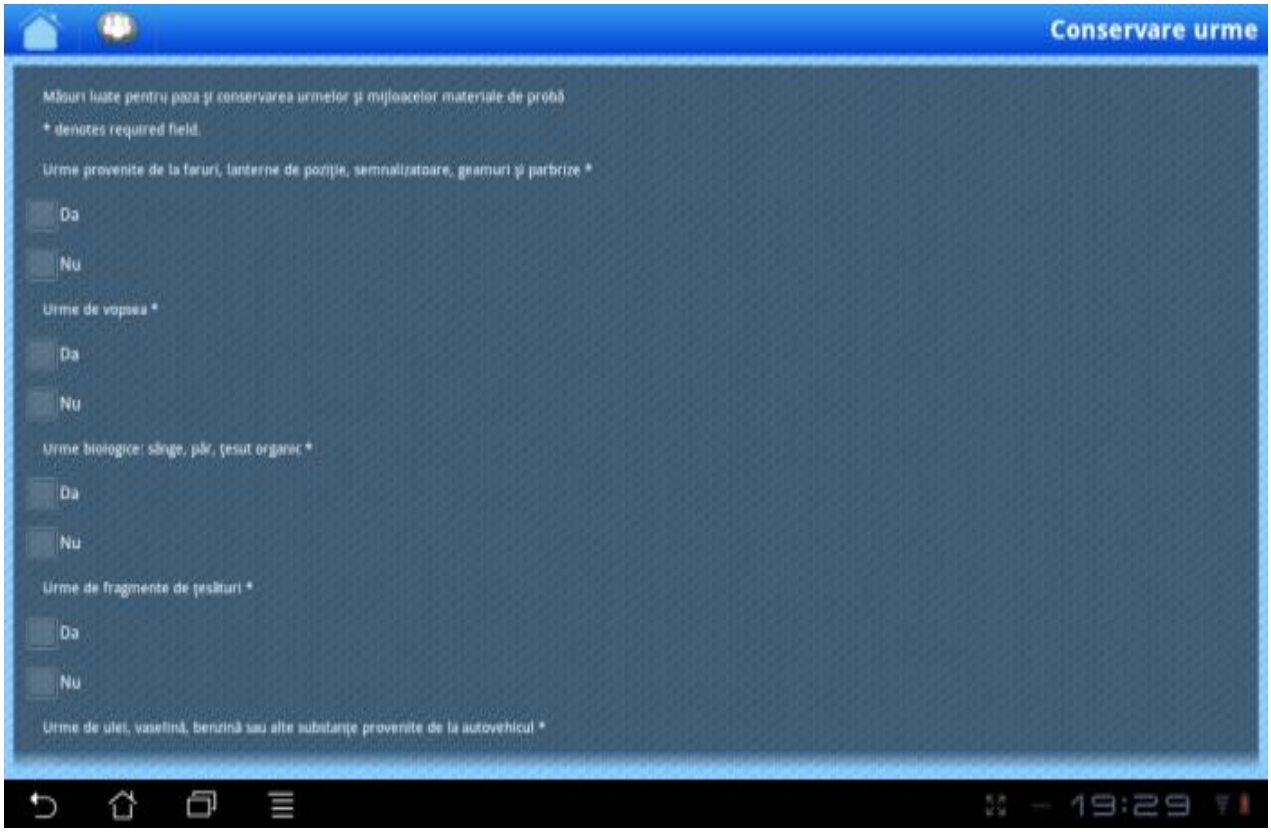


Fig. 9. Trace preservations page

The menu "Distances" allows the collection of data regarding the measurable distances specific to that certain crash site, such as distance between vehicles implied in accident, breaking marks etc.

When all the data are filled in, the user can send the information through the wireless system to the Police station centralized database.

IV. CONCLUSIONS

The system for crash data collection presented in this paper offers significant advantages such as: increased mobility, short time for filling in the data, rapid transmission of information to the centralized database, prevention of potential errors occurred at transcription of data, higher accuracy of the collected data, local storage of data etc. The implementation of this system would not impose high costs. A preliminary sum up of the market price of the hardware and software elements shows that approximately 3000 euro would cover the implementation costs for one police station with 4 intervention teams.

This electronic system provides further benefits for the areas concerned with: establishing "black points" on road digital maps, statistical analysis and data comparisons, accuracy in the judicial system processes. All these advantages are comprised in the larger objective of increasing road safety and diminishing the number of road events with serious injuries and/or fatalities.

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