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A Mobile Accident Report System

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Abstract

Rarely performed documentation tasks usually require support for the user so that the data is recorded both completely and correctly. The broad market penetration with mobile devices like smart phones provides new possibilities for giving support for these kinds of tasks. This paper focuses on one particular widely-used instance of such a documentation task, namely the European Accident Report (aka Agreed Statement of Facts on Motor Vehicle Accident). Firstly we discuss the advantages of media-break-free processing of all the relevant data. Secondly we present the client part of the application, which allows on-site documentation by any of the parties involved. Both application parts can be used for processing claims in the back office. We highlight the possibilities of service-chain integration, the digital accident file generated by using this solution and the resultant advantages for media-break-free processing of claims.

Keywords: Mobile Application, Mobile Documentation System, Mobile Value-added Service

1 Introduction

Technical advances in the mobile device sector have resulted in just about everybody having a mobile phone nowadays. With each new generation of devices the capabilities and application possibilities increase and most users do not exploit the full spectrum of possibilities available to them. As many phones now have a capability comparable to the PCs of 8 – 9 years ago, this potential can be used to provide the user with new applications and services. This could be useful in a variety of situations as most people carry their mobiles with them at all times. This paper describes the results of a current research project which has produced a version of the European Accident Report (cf. docstoc1 2009) for use on mobile smart-phones. This scenario was chosen as it is a

documentation process that a user rarely encounters. In the emotionally stressful situation of a traffic accident a mobile phone with the relevant special application can assist the user to complete the documentation. This paper firstly describes the current paper-based form of traffic accident documentation and from this we derive the advantages of using a mobile digital solution. Furthermore it is then shown how the mobile solution supports the user with the documentation of the accident and how the data acquired in this way is beneficial for claims handling by insurance companies, courts, lawyers and third parties.

2 Research Methodology

This paper describes the concepts and prototype realisation of the second generation of this application. The underlying research approach follows the Design Research cycle, as this enables an iterative defining, processing and redefining of research questions (cf. Vaishnavi & Kuechler 2006) It is regarded as most appropriate approach if one wishes to exploit the potential for process optimisation through using the mobile application. As the current version of this application has not been broadly launched and therefore not evaluated in a sound statistical design, the paper may be seen as research in progress. Taking a more pluralistic view on justifiable research approaches (cf. Frank 2006), the results can be seen as a relevant intermediate step. Starting off from an significant existing problem, an initial design leading to the construction of an artefact and its implementation is derived. Redefining the first version by evaluation under laboratory conditions leads in a cyclical process to consecutive versions with improved capabilities. Within the framework of the research project the advantages for all processes and parties involved are considered, too. The continuous adaptation of the rapid technological advances with respect to mobile hardware and software platforms along the project life cycle must be seen as a major challenge not covered appropriately in the design research literature so far. This aspect alone would imply that this paper reports on research in progress.

At present we have no knowledge of similar projects in the area of traffic accident reporting. Thus we are not able to refer to related work here.

3 Problem Description and Analysis of Current Process

If a traffic accident happens and there is no personal injury, the documentation of the accident may be conducted by the parties involved in the accident without calling the police. In order to ensure that the accident is documented sufficiently and accurately the drivers involved should use the European Accident Report (EAR) form, which is available in most languages of the European Union (docstoc1 2009). A similar form is known in the US, too (docstoc2 2009). For the rest of this treatment we therefore use for our prototype the term Mobile Accident Report (MAR), i.e. dropping any regional reference.

At least one of the drivers involved must have the EAR with them for it to be used. Many insurance companies send their policy holders a copy of the EAR together with their new policy, but most drivers do not have this form with them in their car. This means that an accident is often documented ambiguously or insufficiently and this kind of documentation can lead to misunderstandings and thus delays in claim processing. If

the EAR is used, both drivers record the most important information as to what happened in the accident. For this, the following information is filled in on the form:

In the top section:

general information on the accident (date, time and location of the accident, information about personal injury or material damage, as well as names and addresses of any witnesses)

This section is followed by three columns. The two outer columns (Vehicle A, Vehicle B) should be filled in by the drivers independently of each other. They contain:

- information about the insured (name, address, telephone number), information about the vehicle and the insurance.
- information about the person driving the car at the time of the accident.
- information about the point of initial impact. This point is marked on a drawing provided for this purpose
- information about visible damage.

The middle section of the form contains:

- general statements about how the accident happened.
- a description of how the accident happened. This is done by putting crosses in relevant boxes next to descriptions of possible accident scenarios.
- a squared area for drawing a sketch of the accident. This sketch can however only be made by one of the drivers.

After filling the form in, both the drivers sign it and it is then sent to the insurance companies to inform them of the accident. The policy holder can also send pictures and/or a repair estimate from their garage with the form to their insurance company to assist in the settlement of the claim. The insurance company enters the available data into their computer system, checks the claims of the policy holder, consults the other insurance company involved and, after clarification, recompenses the insured for the damage.

What is important about this form is that no admission of liability needs to be made at the scene of the accident. Both parties involved in the accident describe the situation from their point of view. Each driver should keep a copy of the accident report, so two copies should be filled in and signed, thus ensuring that both parties have all the information on the accident. No later amendments may be made to the information given. A common problem is that the information given is faulty or incomplete due to the emotional situation after the accident, and often the handwriting of the people involved is difficult to read. These factors can lead to additional misunderstandings in processing the accident claims.

There can be additional delays in this process if liability cannot immediately be established definitely or if the police were called to the scene of the accident. If the police are involved, the relevant accident file must first be requested from the insurance company and this is taken into consideration when determining liability. If the information in the files is not conclusive, assessors are called in to determine liability and/or the matter may go to court. A clerk at the insurance company must enter all the

files involved in this process into the computer system, and this can take considerable time and may be a source of error. Moreover, the sending of information in paper form is time-consuming and expensive. Even if digital files are available, it may be the case that the people involved use different formats, thus making an exchange of information more difficult.

If only a simple description of how the accident occurred is available, complicated accident circumstances can only be proven or represented with great effort and expense. This leads to some people demanding compensation for damage that did not occur in connection with the accident in question, as there is a good chance that these claims will not be questioned. This kind of insurance fraud is a big problem for insurance companies and results in insurance companies increasing the premiums for their policy holders. Only an assessor can prove categorically that certain damage must have occurred before the accident in question. However, many insurance companies only call in an assessor when the value of the damage exceeds approx. 1000 Euros, so that many fraudsters use this information and deliberately only make claims below this amount.

4 Solution Concepts and Prototype Implementation

As a part of this research project a version of the EAR has been created for use on mobile smart-phones called MAR. In doing this, it was not our prime intention to merely transfer the form on paper to a mobile-based digital one, but rather to investigate the question of how mobile applications could support users in performing relatively unknown tasks in stressful situations, thus aiming for a generic approach which could be used in different application areas. Moreover, we wanted to study and establish possible advantages not only for the user but also for the insurance company in this specific situation. In particular we intended to enable a media-break-free processing of the case through the use of the mobile client. The rapid and fully digital processing should result in an increase in service quality for customers, and the whole process should be quicker and more transparent for them. The mobile client should check the data entered for discrepancies, thus precluding potential misunderstandings due to errors made when entering the initial data. For the digital file content an XML-exchange format was defined, which enables the integration of data from other sources, e.g. the other driver's insurance company, the police and the assessor (this part is under complete redevelopment at present). In addition, we wanted to provide the user with the possibility to record in detail the circumstances of the accident and the damage incurred with the help of photos while still at the scene of the accident. Like the paper version of the European Accident Report the mobile application should also be available in several languages. This means that information from drivers from different countries can be combined and processed. The aim of the more comprehensive documentation is to describe the circumstances of the accident in such a way that an insurance clerk is able to decide whether to call in an assessor. An assessor must be involved if the estimated cost of repairing the damage exceeds a certain amount laid down by the insurance company or if the damage that the insured would like compensation for does not seem to correspond to what would be expected in that kind of accident.

4.1 The mobile client

Based on the project concepts, the mobile client was developed in two stages. The aim of the first stage was to create a mobile client which reproduced the European Accident

Report as a mobile application. In order to be able to use it on the greatest possible number of phones we based the prototype on Java ME. A significant aspect of the development of the prototype was its modular structure, enabling us to add additional functions at a later date and also enabling an easy transfer of the application into different languages. As an additional aid to the user in filling in the accident report, this first version also had the capability to take pictures of the licence plate numbers of the vehicles involved using the mobile phone camera. These pictures could be analysed on a server using OCR (Optical Character Recognition). Given a secured, authenticated access the car owner can download the relevant insurance information without any manual input (Spiekermann 2007). This procedure meant we could largely avoid the problems that arise when entering text using a mobile phone keypad or touch screen. The user also had the possibility to enter text at this point in case the phone did not have a camera or in case light conditions were too poor for the licence plate recognition application to function. Another program module establishes the circumstances of the accident using the questions found on the paper version of the accident report. However, the user is helped with the filling-in process, thus ensuring that he does not make contradictory statements about the accident. After the questions have been answered the user is given an overview of his answers so that he can check them at a glance and see if he has made any mistakes. This step-by-step procedure has the advantage of not overtaxing the user, especially in this stressful situation. This procedure ensures that the report is complete and unambiguous. After the questions have been answered the user can mark where his vehicle has been damaged on the sketch of a car. The indication of the position of the damage is done using a rectangle (see fig. 1) which the user can move by using the keys. The area selected is thus only a rough indication but is sufficient to show the insurance clerk where the main damage has occurred and give him an idea of the estimated value of the claim. The user could not make a sketch of the accident location with the first prototype, but using the photo function he could document the damage caused and also the whole scene of the accident. Lastly, all the data collected is sent via the mobile phone network to the back-end server.

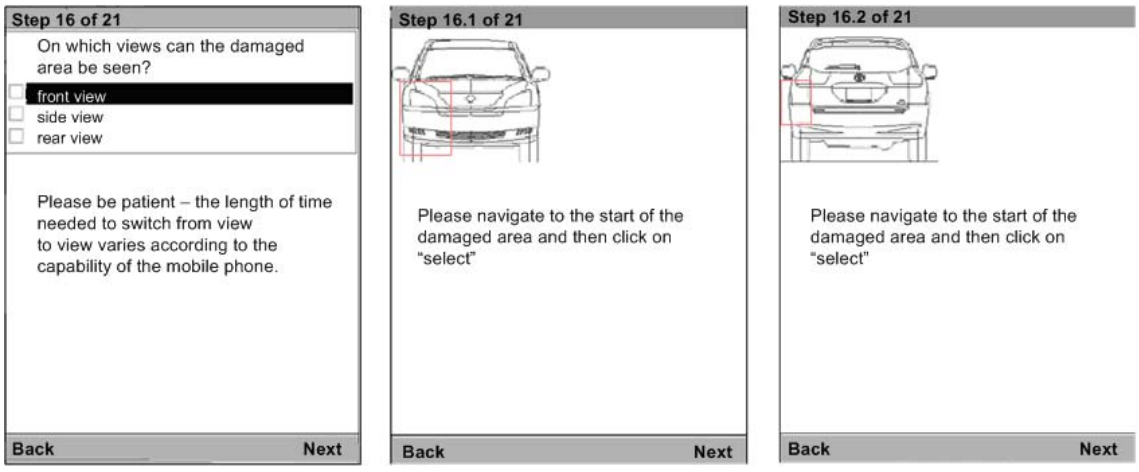

Figure 1: Mobile client of the first generation MAR (Klaß & Knopp 2007)

The limitations of Java ME were apparent when the 1st generation prototype was evaluated. In a usability test with different mobile phones, the representation varied according to the screen resolution available. This meant that a uniform representation of

text in certain areas was not readily possible. The application reacted slowly, depending on the hardware used. Most testers described the interaction with the program using the keypad as laborious. The camera function could only be used on a fraction of the mobile phones because access to hardware functions was not always possible using the Java APIs supplied (at the end of 2006). In some cases we required manufacturer-specific APIs for which freely accesible documentation was partially unavailable. This in turn meant, that a large part of the content in the form, which should have been filled in automatically, had to be keyed in manually by the user. People who did not regularly send text messages on their mobiles and who were thus not used to keying in text had particular problems with this. If access to the camera function was available, processing time was reduced by about 30% compared with the paper version of the form. Obviously, a redesign based on superior technology capabilities had to be the next development cycle.

4.2 2nd Generation

The realisation of a new implementation of the client taking into account the limitations of the first generation was initiated. As such new applications will only come onto the mass market in about 3 – 5 years, we decided to design the next generation on the basis of the capabilities of the mobile smart-phones that we considered would be available then. For this reason a Windows Mobile Smartphone was used for the implementation. This is a phone in the medium to upper price range at the moment. Considering the past and current development in the field of mobile phones we assume that the capabilities of top of the range phones will reach the mid-range market segment in two years and thus be mass market products. We assume that there will be an almost universal UMTS network (with HSDPA/HSUPA) and that the costs of data transfer for this application will be negligible. The Smartphone's touchscreen is primarily used for interaction.

Choosing a phone which has Windows Mobile as its operating system meant that access to hardware-near functions (like unified access to camera functions, access to the GPS-receiver etc.) was possible without making allowances for manufacturer-specific APIs, only APIs belonging to the Compact Framework were used. This enabled a fast realisation of the next stage prototype. The aim of the 2nd generation was to rework the visualization and to integrate additional functions for the automatisation of the documentation. In the case of this 2nd generation client, data entry is made using the touchscreen. The stylus is used on a virtual touchscreen keyboard to enter text.. The user has the possibility of documenting the damage caused in the accident in detail, not only with the photo function but also by using the stylus to mark the damaged points or areas freehand or by positioning a rectangle on a picture of the vehicle (see figure 2). The damage can be classified in different categories, e.g. scratch, dent or hole. This information can be used later for roughly estimating the total repair costs. For the documentation of the accident location, which takes the form of a hand-drawn sketch in the paper version of the report, the new client can use the GPS receiver integrated in the mobile phone to determine the exact location automatically. If this is possible the user gets an aerial picture on which he can indicate the position of the vehicles involved in the accident. The advantage of this procedure is that this information can be interpreted completely correctly. Hand-drawn sketches usually have incorrect proportions so that an

insurance clerk may not be able to reconstruct the accident location accurately using the sketch. The mobile application is designed in such a way that it checks the language selected on the phone at the start-up, and then suggests this language for the application. The user also has the opportunity to select a different language at the beginning (Gille 2008).

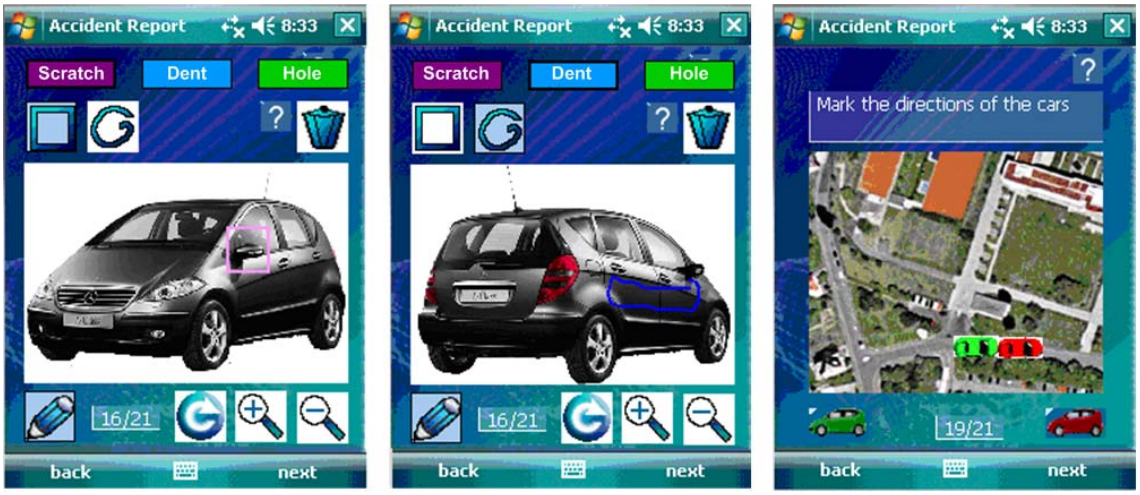

Figure 2 – Mobile Client of the 2nd Generation (Gille 2008)

When the data acquisition process has been completed, all the information that is collected during the documentation is sent in a special XML- exchange format to the specific back-end server. The server then sends this data to the various parties involved. In this way the people involved in the accident and their insurance companies immediately receive the data needed for settling their claims. We consider that a trusted third-party could act as an intermediary, which is running the back-end infrastructure. Additional information streams from other parties (police, insurance clerks, assessors etc.) can be appended to the database.

4.3 Back-End Services

When an insurance company receives the digital files of an accident these are processed in the back office and the procedures necessary for settling the claims are initiated. Settlement is speeded up considerably as the use of the mobile client means the digital files generated by the parties involved in the accident are already available. Additional information such as pictures of the accident location (in addition to the GPS-coordinates) and photos of the damage to the vehicles can be attached to the report so that the cost of the settlement can be estimated. This information is important for the insurance company so that they can decide whether to call in an assessor, either because the value of the claim exceeds a certain amount, or because it is doubtful if the damage is all a result of this particular accident.

For this purpose the clerk can call up a visualization which shows the damage on a 3-D model (see figure 3). This enables him to decide whether the damage is concordant with the circumstances of the accident that have been given. The clerk is able to form an

impression of the state of the vehicle and the accident location using the attached pictures of the accident.

This kind of photographic documentation can also be useful if a policy holder tries to claim more than once for the same damage when this damage is not directly attributable to a particular accident. Even if the insurance company did not have to pay compensation for this damage, it is already on record at the insurance company and they can decide immediately whether a more precise analysis of the circumstances of the accident and a closer inspection of the damage are necessary. Using this system the insurance companies could collaborate to protect themselves against policy holders who try to commit insurance fraud.

Figure 3 shows the representation developed in this research project for use by the clerk or assessor. This person has the possibility to call up information about the vehicle and the driver. The damage is represented on the 3-D model in the form of a pictogram. The pictures supplied by the user can be compared with the described damage so that a direct visualization of the damage to the vehicles is possible (Lempa 2008).

The features of the back-end solution as well as the appropriate provider model to collect and store the data opens up a difficult discussion on the balance of interest and data protection. Due to page size limits we have to postpone most of these design considerations to another presentation. Nonetheless a short architectural overview is given in the next section to provide an understanding of the inherent service responsibilities and roles.

Figure 3 – Visualization of the damage information from the digital accident report (Lempa 2008)

4.4 Architectural System Setup

When designing the 2nd generation of this research prototype we considered the integration of all the parties involved in the settlement of the claim. In this connection we divided the parties involved into 4 groups. The first group is the policy holders, who,

if they have an accident, document it using their mobile phone running the mobile client and then send this information via the mobile phone network to an intermediary. This intermediary provides the necessary WMS (Web Map Service) for the visualization of the accident location using an aerial picture (Jazajeri 2007). Moreover, this intermediary also has access to a database of official house coordinates so that the accident location can be given directly in relation to an address. During this project the WMS-Server was realized with the help of MapServer (MapServer 2008).The required aerial photos were supplied by the "Landesamt für Vermessung und Geobasisinformation Rheinland-Pfalz"[1] (The Regional Office for Land Surveying and geo-referenced basic data for Rhineland-Palatinate). Using the information given by the policy holder, the accident documentation is then sent to the relevant insurance companies and to the people involved in the accident. The process chain is indicated in Figure 4.

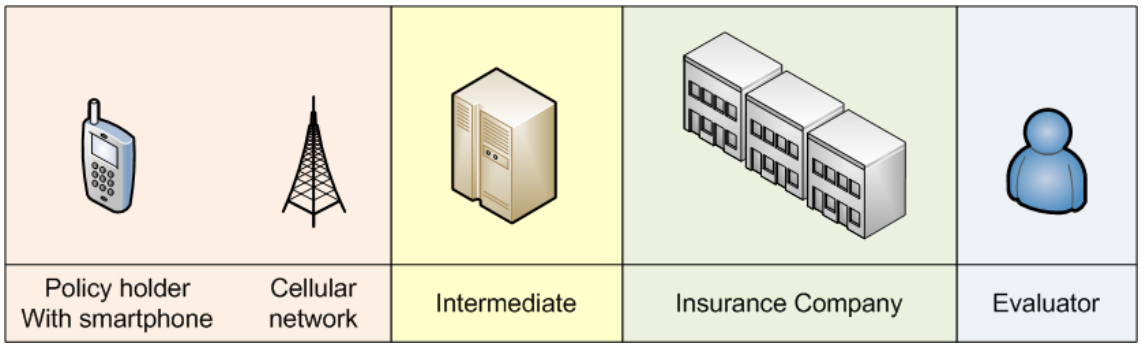

Figure 4 – The stages involved in the "Mobile Accident Report" scenario

In their back offices, the insurance companies can then collate and process the data for both the parties involved in the accident. If the value of the claim exceeds a certain amount, an assessor can be called in and this person can also take an initial look at the visualization of the accident damage that this project enables. The information given in the assessor's report can be sent via the insurance company and the intermediary to the other party's insurance company.

[1] Landesamt für Vermessung und Geobasisinformation Rheinland-Pfalz: http://www.lvermgeo.rlp.de/

5 Economic Prospects

In order to establish this kind of mobile value-added service on the mass market it would have to have benefits for both parties, i.e. a kind of win-win situation must be created. For the insurance policy holder, this benefit could be the reduction of insurance premiums, for example, if the client is used for reporting a claim, or a faster processing and settlement of the claim. The use of the client is also advantageous for the insurance company and the main benefit comprises the provision of the completed MAR by the policy holder in the form of a digital file. The claim is put in immediately after the Accident Report has been completed and thus the policy holder does not have to worry about not registering his claim in time. There are no costs for entering the (previous) handwritten report into the computer system and the risk of error inherent in this process is removed. The user is guided through the use of the mobile client and the insurance company receives a complete and unambiguous documentation of the accident. The client ensures that the user does not make any contradictory statements that could complicate the processing of the claim. As the report can be enhanced by the addition of photos and pictures, it is easier to envisage what exactly happened. The value of a claim can be estimated using the pictures documenting the damage incurred and this estimate can be used as a basis for deciding whether to involve an assessor. As the documentation of the accident and the damage is so comprehensive, many cases can be discovered where claims are being made which have no connection with the accident in question. The number of cases of insurance fraud could thus be reduced, and the resultant reduction in costs could benefit all the policy holders. In this way it would be possible to provide reductions for those policy holders who make use of the mobile client for documentation. This last argument is supported by some recent figures reported for Germany: fraud by car insurance policy holders is estimated to exceed 1 billion Euros per year, which has to be covered by all customers. Without fraud the average reduction in policy prices could be approx. 10%. (dir-info 2009).

Broad acceptance of the mobile client is necessary if it is to be used. This means that this electronic file would have to be accepted by all insurance companies without exception, because otherwise a paper report would also have to be filled in at the scene of the accident, making extra work for the user. For this reason it would not be possible for one or only a few insurance companies to introduce it on their own; if this were the case, there would only be limited acceptance of the digital MAR in the insurance industry.

The widest acceptance on the part of the insurance companies can be achieved through the involvement of a company to act as trusted intermediary between users and the insurance companies. This company can provide the application for the user. After somebody has been involved in an accident and has used the application, they can send the MAR in digital form to the intermediary and the intermediary can determine which insurance company to send the file to. At this point the digital file can be sent to other bodies in addition to the user’s insurance company, for example the other insurance company concerned or the police. This way of proceeding is advantageous as all the people involved have all the relevant documents right from the start and the case can be dealt with quickly. The complete documentation means that an insurance company employee can decide whether to call in an assessor in this case and once this decision is made, the assessor can be sent the required file digitally too.

The user has to be provided with the mobile software client in order to be able to use it. The user needs to be able to download it on the internet from the intermediary's web-site free of charge and for his particular mobile phone. Ideally this should be done when a new insurance policy is taken out or when the user buys a new mobile phone so that the user already has the application available when he needs it. This would ensure that the use of the mobile client would involve no more effort that taking the paper version of the Accident Report out of the glove compartment. To enhance usability and convenience we suggest a personalisation of each downloaded software client in conjunction with the issuing of an insurance policy. Clearly, this approach needs a sophisticated security concept, as any misuse or spying of other people's personal data has to be avoided. The same holds true for the above-mentioned OCR mechanism for number plates and its use as an automated form-filling method (pre-qualification). In a separate report we will deal with the manifold design considerations and possible solutions.

At the documentation stage, the intermediary obtains all the necessary information for filling in the form from the insurance companies involved. The user only has to enter his name, licence plate number and date of birth. This information is sufficient to clearly identify the insurance policy concerned. If the vehicle is being driven by someone other than the policy holder, the user has the opportunity to enter some of the additionally required information in text form by hand.

The intermediary does not need to have information available about all the potential users before an accident, as the vehicle owner provides the required data. If this information is not provided, there is the possibility to start a search to find out which insurance company is responsible. Once the insurance company has been found (by matching with a number plate database), it can provide the required personal data and this information will be filled in automatically in the accident report. This ensures that the user is relieved of a part of the filling-in process. In addition, it has the advantage that the other person involved in the accident is sure that he has been given the correct personal details by the other driver. After they have filled in their parts of the accident report, the two drivers receive a digital copy of the whole accident report from the intermediary.

6 Summary and Outlook

The second generation of the mobile accident report represents the basis for the mobile data collection necessary for an accident documentation. It supports the processing and the collation of the data when the case is dealt with in the back-office. The software modules implemented for the prototype realisation provide the basis for further research and development in related areas (such as large construction site inspections etc.)

During the development of the next generation prototype one focus of the research will be on the various aspects of data protection. The second generation prototype allows the gathering of sensitive personal data after only a small number of personal data has been provided, e.g. name, licence plate number and date of birth. Within the framework of further development, methods and techniques of ensuring that this information is only available to authorized persons will be compared, evaluated and implemented. Moreover, care will be taken to ensure that the documentation cannot be amended or

disputed at a later date so that this electronic file can also be used as the basis for a lawsuit.

The cameras integrated in the mobile phones used in the prototype are not as sophisticated as conventional digital cameras. For this reason the user has to be assisted when taking photos as he cannot assess the quality of the picture taken in the small display. During further development, functions will be integrated in the client that will help the user to appraise the picture quality. The user will be warned if there is not sufficient light or if the picture is blurred, without him having to check the photos manually. In the future we may expect the quality of cameras integrated in mobiles to come closer to that of conventional digital cameras. In particular, the integration of a flash function would be necessary for the documentation, so that photos can also be taken in bad light.

At the moment, the representation for the accident sketch uses the orthophotographs provided by the Regional Office for Surveying and Georeferenced Basic Data for Rhineland Palatinate, supplied for the area of the middle Rhine valley for this project. In order to make a visualization possible for a location outside this area, we are currently evaluating an additional visualization using the project OpenStreetMap (OpenStreetMap 2008) in the next stage of development. Besides the maps provided by the community, this data is to be upgraded with another visual layer. This layer shows the position of street signs and rights of way and will support the user when filling in the report and the clerk when dealing with the claim. When integrating this, we will also investigate whether the accident documentation can be supported with an interactive 3-D model. The module necessary for integrating interactive 3-D models (Vetter 2008) has already been developed in a research project and needs to be adapted for integration in accident documentation.

The aim of the further development of the mobile client is to optimize the existing mobile application in such a way that the full support of the user for the documentation is achieved. As the police or an assessor can be involved in the accident documentation in addition to the drivers concerned, special mobile clients will be developed in the next stage of development which can be used for documenting the accident and assessing the damage. The information gained in this way will be attached to the electronic file for the accident. The use of the electronic file makes it possible for all the parties involved to follow the progress of the case clearly. This will save time otherwise spent on unnecessary communication to find out the current status of the settlement process. The data collected about accident black-spots can be passed on in an anonymous form as statistics and visualization to public authority planning teams, for example.

We hope to evaluate the performance of the third-generation prototype in a field study with a group of users. In this evaluation we will examine not only the usability but also the integration into the existing workflow of an insurance company. In this connection the aspect of user acceptance, especially in such a stressful situation, will also be studied.

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