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A Mobile Platform for Roadway Incident Documentation

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Authors

Su, Ray J.
Chan, Ching-Yao

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A Mobile Platform for Roadway Incident Documentation

Ray J. Su
Ching-Yao Chan

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California. This report does not constitute a standard, specification, or regulation.

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Table of Contents

Executive Summary	3
1.0 Background and Introduction	5
2.0 User Requirements	5
3.0 Conceptual System Architecture	6
4.0 Field Application and Usage of Mobile Documentation Platform	8
5.0 Mobile Documentation Platform Architecture	10
5.1 Hardware Architecture	10
5.2 Software Architecture	11
Palm OS Application	11
Conduit Development	13
Java Server Application	15
Installation Suite	16
6.0 Conclusion	17
References	18
Appendices	19

Executive Summary

This report is part of the final report and the deliverables for TR0002, Collision Recording and Documentation, sponsored by California Office of Traffic Safety, and contracted through California Department of Transportation.

Roadway incidents, especially collisions, often result in traffic congestion and travel delays, in addition to the direct damage to the vehicles and the injuries to the people involved. The subsequent congestion is mainly caused by stopped vehicles or lane closure, but it is often intensified by slowing vehicles with drivers observing the accident scene. The effects of these phenomena on the highway transportation system are significant in terms of their direct hazards and the associated losses in time delays, energy usage, and environmental impact.

The subject discussed in this report focuses on the post-incident handling phase of the problem, with the intention to moderate roadway congestion and to enhance the safety of law-enforcing officers. The project is sponsored by the California Office of Traffic Safety, and conducted by California Partners for Advanced Transit and Highways (PATH) program with assistance from California Highway Patrol (CHP). The objective of the study is to develop application tools, represented by a combination of computer hardware and software that can be used by CHP to record, document, and analyze roadway incidents quickly and effectively. The key is to reduce the time spent by officers on the incident scene, thus resulting in a direct decrease in roadway blockage and/or traffic congestion.

With the recent developments of powerful processors and low-cost electronics, there have been a large number of hand-held computers in circulation in the last few years. The portability and the low-cost features of such devices prompt us to envision that a hand-held computer is an excellent candidate for law-enforcement use, in particular for the type of applications that we have proposed. Our concept then evolves from a portable computer into an architecture that encompasses a collection of mobile platform with versatile software, wireless communication, and database functionality.

In this report, we described the development process of an application tool that is intended for the use by law-enforcement officers. The application tool is targeted for information gathering at traffic accident scenes. The potential benefits lie in the resultant reduction of incident documentation time, and thus leading to a faster scene restoration, traffic resumption, and reduced congestion caused by roadway incidents or collisions. During the development of this tool, we have seriously considered the real-world concerns of users and communicated through several channels to ensure the desirable features are implemented properly. The focus was placed on the time saving and user-friendly requirements that are absolutely necessary for the tool's intended use. Initial efforts have resulted in a functional module that possesses text and graphics entry options, menu-driven displays, and a report retrieval database.

Since the mobile platform is conceived as an integral component of an incident documentation system, it is structured adaptively for additions of other input and communication devices. The flexibility in the functionality of the tool presents a great potential to be used as a stand-alone module or to be coupled with expanded functions. As mentioned earlier, the usability of the basic application can be greatly enhanced by integrating input devices with the mobile platform. In the implementation described in this report, the tools that were used, such as the wireless devices, and the software options, such as operating systems and display presentations, were all adopted from the commercially available products. As a result, we demonstrated that an integration of commercial-off-the-shelf products can be a successful approach for the developments of incident handling tools. On the other hand, we should also realize that the evolution of hardware and software products occur very quickly. Therefore at any stage of deployment, extensive search and thorough evaluation of latest developments in related areas should be conducted. Devices that provide additional features and cost-effective options will prove to be more powerful and suitable choices for those tools deployed by future studies.

1.0 Background and Introduction

Roadway incidents, especially collisions, often result in traffic congestion and travel delays, in addition to the direct damage to the vehicles and the injuries to the people involved. The subsequent congestion is mainly caused by stopped vehicles or lane closure, but it is often intensified by slowing vehicles with drivers observing the accident scene. The effects of these phenomena on the highway transportation system are significant in terms of their direct hazards and the associated losses in time delays, energy usage, and environmental impact. To deal with these problems, transportation professionals have worked diligently from several aspects of the problems presented by collisions and accidents. For example, collision warning and avoidance systems intend to reduce the number of accidents. Safety restraint systems aim to mitigate the degree of injuries and cut down the fatality numbers. The subject discussed in this paper focuses on the post-incident handling phase of the problem, with the intention to moderate roadway congestion and to enhance the safety of law-enforcing officers. The project is sponsored by the California Office of Traffic Safety, and conducted by California Partners for Advanced Transit and Highways (PATH) program with assistance from California Highway Patrol (CHP). [1]

The objective of the study is to develop application tools, represented by a combination of computer hardware and software that can be used by CHP to record, document, and analyze roadway incidents quickly and effectively. The key is to reduce the time spent by officers on the incident scene, thus resulting in a direct decrease in roadway blockage and/or traffic congestion.

With the recent developments of powerful processors and low-cost electronics, there have been a large number of hand-held computers in circulation in the last few years. The portability and the low-cost features of such devices prompt us to envision that a hand-held computer is an excellent candidate for law-enforcement use, in particular for the type of applications that we have proposed. In the following sections, we will discuss the user requirements, the actual application and usage of the Mobile Documentation Platform in the field, and the hardware and software architecture involved in the platform.

2.0 User Requirements

Since the tools in consideration are intended for the use of CHP or law-enforcement officers, we have worked closely with and received continual assistance from California Highway Patrol during the development process to ensure that we understand the user needs. We arranged to meet and hold discussions with a group of CHP officers from the Field Service Section in Sacramento, the Major Accident Investigation Team (MAIT) group from the Vallejo office, and we rode with officers on duty in the Oakland and Marine County areas to observe actual work demands and processes in real-time situations. Through these discussions and contacts, we have acquired a considerable amount of first-hand knowledge in user requirements. Here is a list of observations and summaries from the conversation and ride-along with CHP officers that we took in consideration while developing this mobile platform:

- The safety of officers is priority number one. The operating environment at accident scenes is quite hazardous and any harm to the officers will only cause further problems at an incident scene.
- Efficiency is the key for the usefulness of the intended tool. Any amount of time saved is very valuable. Expedition of data entry is critical.
- Stand-alone or combined use of devices to speed up information gathering will be useful, such as bar code readers and magnetic stripe readers for scanning vehicle identification numbers, driver license identification, and vehicle license plate numbers.
- Compatibility of data formats with other software used by CHP, such as California Automated Reporting Systems (CARS), will be a big plus.

From the ride-along with CHP officers on duty, we also learned that in some situations involving complex incidents, several officers might share responsibilities to clear out the accident scene as fast as possible. Therefore, it will be desirable to have flexible partitions of functional elements within the application tools so that selected segments can be handled separately by individual officers.

The operating environment must also be taken into design considerations for tool developments. For instance, law-enforcement officers are usually working in stressful situations with limited time for data entry; the background lighting may be of various degrees; and the officers must remain vigilant for traffic and surroundings, thus there are plenty of distractions and intermittent interruptions. These considerations become important in designing the interface of software presentation.

It was concluded from communications with CHP that the basic requirements of the tool package should include the following features:

- Time-saving
- Ease of use
- Smooth data transmission
- Flexibility in function expansion and division
- Flexibility in integration with other hardware or software.

3.0 Conceptual System Architecture

The application tool in development within this study is conceived as part of an integrated system that is intended for use by CHP or other law-enforcement officers. A diagram depicting the components and their linkages is given in Figure 1. The arrow lines within the diagram indicate the potential transmission of data between components.

The state of California has a plan to equip and update every CHP vehicle with a notebook computer, which is part of the Patrol Officer Environment Automation Project (POEAP). The computerized on-vehicle system allows the officers to report, transmit, and acquire information

while they are patrolling on the highways. This in-vehicle computer and the associated radio, desktops, and servers constitute the existing equipment in place or in development for CHP.

The mobile platform in development resides on a mobile or hand-held computing device, which is the central point of the integrated system. Embedded in the mobile platform are the necessary software and hardware that can be utilized by the officers as a stand-alone tool directly or as a facilitating bridge to bring information from other input devices, such as bar code scanner, magnetic stripe reader, camera, voice recorder, and so on.

The development of the application tool does not exclude the possibility of using other devices directly with the existing platform, as indicated by the two separate arrows from the appending device group to the two platforms. However, since the mobile platform is particularly appealing with its portability, it will be ideal to integrate other input devices with the mobile platform to maximize user convenience. For example, the mobile platform conceptually can be integrated with a bar code scanner or a magnetic stripe reader and a wireless connection. These devices can allow a CHP officer to remotely inquire the background information on driver licenses and vehicle registration through the supporting network quickly and effectively while he is surveying accident scenes or talking to drivers and witnesses.

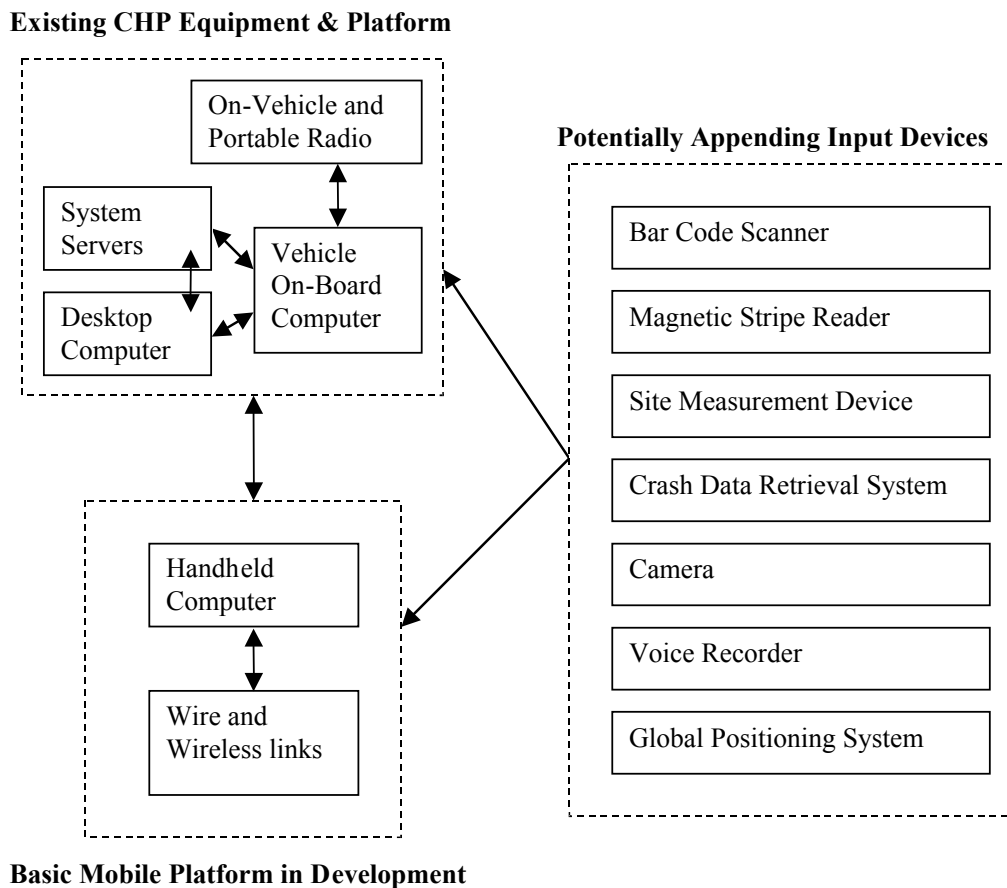


Figure 1: Conceptual System Architecture

4.0 Field Application and Usage of Mobile Documentation Platform

This section will describe how the Mobile Documentation Platform is envisioned to be used by the CHP officers. There are four main features of the platform that addresses the previously listed user requirements:

1. Report documentation with a Palm OS Application,
2. Database storage of reports within the Palm handheld,
3. Synchronization of report data between the handheld and existing laptop/desktop computers.
4. Wireless communications between the handheld computer and existing CHP equipment / platform.

The user can perform incident scene documentation by generating a report on the Palm OS Application. Specific information regarding the incident such as time / date, specific vehicle information, specific information about people / witnesses, information about the location, and specific environmental and scenario information can be documented within this report. The user can document all this information by simply tapping and navigating through the forms of the handheld application with the stylus. No prior knowledge of the Palm OS Cursive is needed to perform these tasks, thus addressing the requirement of ease of use.



Figure 2: Screenshot of Mobile Documentation Palm Application: Main Menu

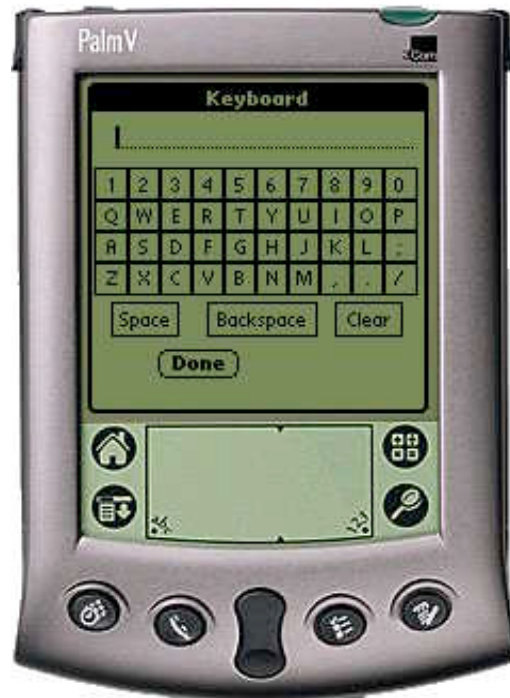


Figure 3: Screenshot showing modified keyboard menu for easy data entry.

Once the incident has been documented, they can be saved in the Palm OS database. This report database can then be retrieved for future review, deleted, or edited if any necessary changes need to be made. In addition, not all fields of the report need to be completed. If desired, the user can save the half completed report and return at a later convenience.



Figure 4: Saved Reports Menu - Reports can be saved, deleted or edited.

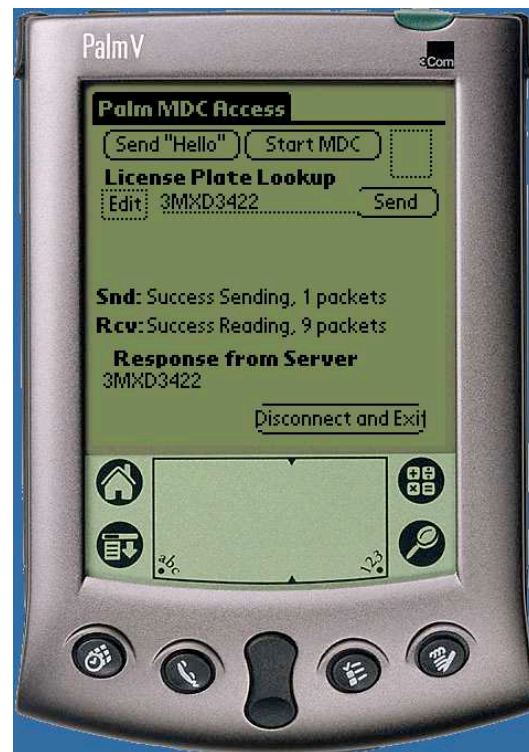


Figure 5: Palm Application menu screen with wireless communication option.

After time, a collection of reports from multiple incident scenes will accumulate on the handheld database. Transfer of these reports can easily be accomplished by the standard handheld synchronization process called a "HotSync". This data will be transferred to the laptop/desktop in a format that permits easy integration into existing report documentation software. At this point, additional changes to the report can be made at the convenience of the office setting and integrated with other documented information from the incident scene.

Finally, beyond the report documentation, the handheld application provides wireless communication capability between it and existing CHP equipment / platform. This will essentially give the officers the ability to use software features on existing CHP equipment from the handheld device alone. As an example, officers typically can look up vehicle license plate numbers or driver's license number through the MDC (Mobile Digital Computer) located in the officer's cruiser. With the handheld application, the officer can communicate wirelessly with the

MDC and perform the same lookup on the handheld without returning to the cruiser. Furthermore, the user can also perform the synchronization of reports from the handheld to the cruiser to prevent the accidental loss of reports during the course of duty.

5.0 Mobile Documentation Platform Architecture

This section will focus in greater detail about the specific hardware and software implemented in mobile documentation platform as used in the previous section.

5.1 Hardware Architecture

The hardware architecture for the mobile platform includes the following sub-systems:

- Mobile handheld unit: Palm Handspring Visor Deluxe

It is not necessary to use the Handspring Visor or even a Handspring handheld at all. The only requirement is that the mobile handheld device incorporates the Palm Operating System. This is in part because the application was developed with the Palm Operation System API (Application Programming Interface).

- Wireless Ethernet Module for the handheld: Xircom SpringPort Wireless Ethernet (SWE1130)

This Ethernet Module is part of a family of “Springboard” modules made specifically for Handspring handhelds. It provides 11Mbps data transfer rates, and 128-bit WEP (Wired Equivalent Privacy). However, the only requirement of this hardware is that it is IEEE 802.11b compatible. This module works in conjunction with the Palm Handspring unit.

- Any Laptop or Mobile-computing device with an available PCMCIA slot.

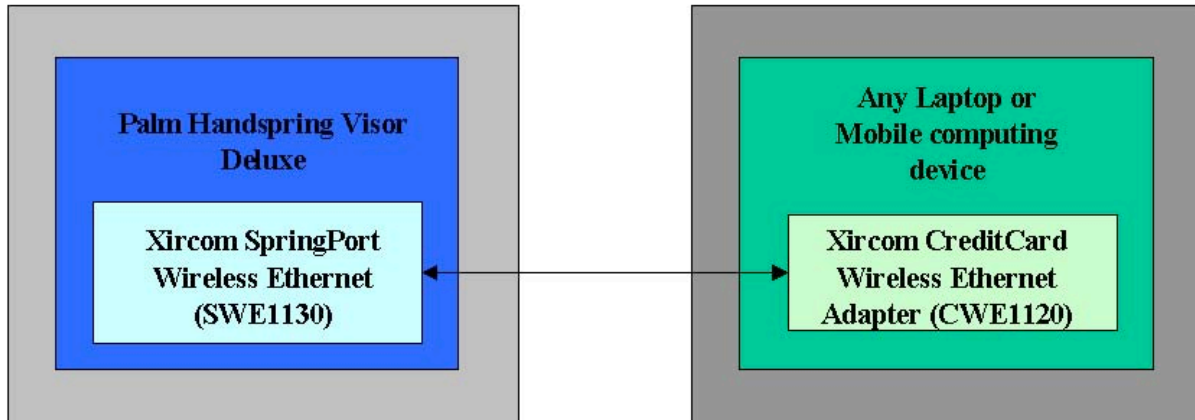
This is essentially part of the existing equipment and platform, which is mostly available to all CHP officers.

- Wireless Client Ethernet Adapter (PCMCIA) : Xircom CreditCard Wireless Ethernet Adapter (CWE1120)

This wireless Ethernet adapter will work in conjunction with the laptop or mobile computing device and communicate directly with the Palm handspring device and wireless ethernet module. It should also support IEEE 802.11b and can have Wired Equivalent Privacy.

The diagram below will show the connectivity and interactivity of the hardware units.

Hardware Architecture



5.2 Software Architecture

The following lists the software that was developed to support the Mobile Documentation Platform. Prior to installing or running any of the following software, the Palm OS HotSync Manager should be installed. The HotSync Manager software should be accompanied with a Palm OS enabled handheld device.

Palm OS Application

The Palm OS Application is the cornerstone of the Mobile Documentation Platform. It is where all the reports get generated, saved, edited, synchronized, and where all wireless communication originates.

Development of the Palm OS Application was completed using Metrowerks Codewarrior for the Palm OS (ver. 7.0). Development of all program logic, user interface forms, database, and wireless functionality was completed within this IDE (Integrated Development Environment). The Constructor for Palm OS is a sub program within the Codewarrior IDE where creation and layout of all Palm Forms (the user interface pages) is done.

Debugging is also integrated within the Codewarrior IDE and is complete by downloading the POSE (Palm Operating System Emulator) application. The POSE is able to emulate the operating system of the physical handheld and thus developed application can be loaded onto it and tested. The screenshots in figures 2-5 are screenshots of the POSE operating on the Windows Platform. It can be downloaded at www.palmos.com/dev.

Completion of development of the application results in an application file with the extension '.prc'. These PRC files are called Palm OS Resource Collection files and contains the Palm OS Application. They must be loaded and queued in the HotSync manager to be uploaded to the handheld during the next HotSync process.

With the user requirements described earlier, the development of the software was initiated with the functional elements to emulate a subset of California Automated Reporting System (CARS), a software application developed in-house by CHP for reporting incidents by CHP officers. The

data entry categories in the handheld application resemble those contained within CARS, with options for expansion and modifications.

The features of this software application include:

- Data access security or authentication, such as login or identify verification.
- Data entry for incident-related information, such as people, vehicle, roadway, etc.
- Data entry selection, with options for texts or graphics.
- Data (incident report) storage and retrieval.
- Data (incident report) transmission to other computers.

A hierarchy outline of the data entry categories shows the sequence and functional elements of the basic version already developed:

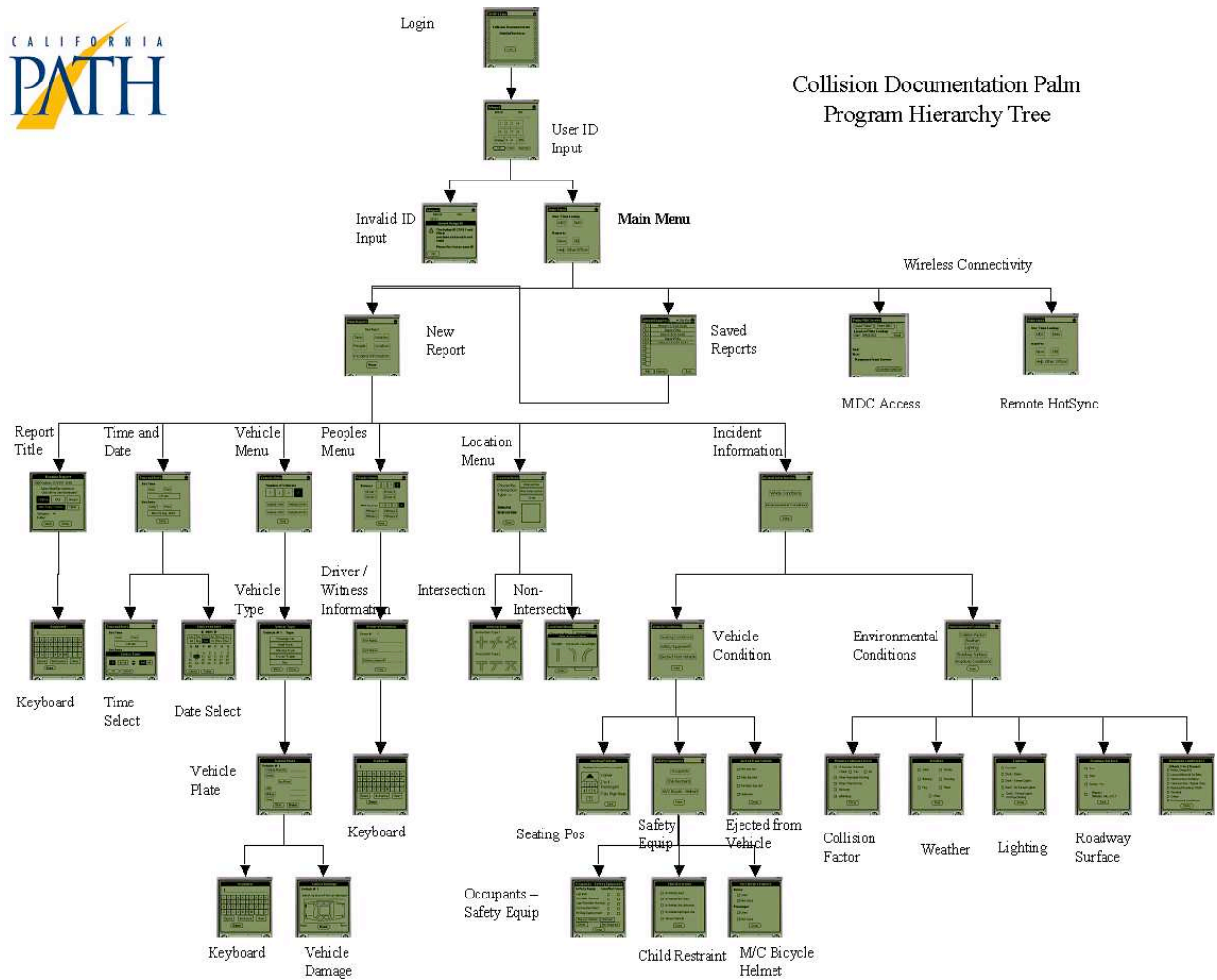


Figure 6: Palm OS Application menu hierarchy.

The Palm OS® allows the user to select an entry by touching the screen with a stylus pen. Palm-based handheld computers also are equipped with the capability to recognize hand-written characters in a window located at the lower portion of the screen. However, as an option, we also provided a reduced keyboard for data entry (Figure 3), as there was concern over entry speed.

As previously mentioned, the ease of use and time saving features are critical factors in the intended application, therefore the user interface is presented with graphic representations whenever possible to potentially reduce the time for data entry. Figure 7 and 8 give two examples of such features. Figure 7 prompts the user to select a region of vehicle damage, and Figure 8 shows a pre-drawn set of intersection types for the user to choose from. Similarly, pull-down menus or automatically generated lists of available options are shown in the display when the user chooses a certain category, such as dates or times of a day.



Figure 7: Interface for Vehicle Damage Entry



Figure 8: Interface for Intersection Type Entry

Screenshots of menu forms within the Palm OS Application can be seen in Appendix A.

Conduit Development

A conduit is a Windows DLL module that provides a translation bridge between a Palm Computing platform device application and a particular desktop application. A conduit is responsible for the application's data during the synchronization between the handheld and a desktop computer. The conduit needs to:

- Open and close databases on the Palm device.
- Determine whether data should be uploaded only, downloaded only, or some combination of both.
- Appropriately add, delete, and modify records on the handheld and on the desktop.
- Be able to work within a multi-user environment where more than one Palm handheld may be syncing to the same network or desktop computer (though not necessarily at the same time).
- Convert the data in the application's database records to appropriate data structures on the desktop computer.
- Optionally, though usually recommended, compare records so that only modified records are synced.

Our mobile platform employs a Java based Conduit. Any sort of conduit development requires downloading and installation of a CDK (Conduit Development Kit), which can be downloaded here: <http://www.palmos.com/dev/tech/conduits/>.

While the conduit can be configured to synchronize information in a bi-directional manner, our mobile platform's conduit operates uni-directionally. Our conduit will transfer all report data in the Palm OS Application's database to the desktop computer in the form of a text file. This was purposely done so that the exported text file can easily be imported into existing CHP software such as the CARS. The exact formatting of the text file can be seen in Appendix B. Should the formatting be incompatible with importation into the CARS program, changes can easily be made by modifying one of the Java classes that defines the conduit behavior.

Normally, synchronization is done by placing the handheld in its cradle and pushing the HotSync button. An extra feature has been implemented in the Palm OS Application that allows the HotSync process to be done wirelessly. This feature can be accessed from the main menu of the handheld application. Its results are essentially the same as a local HotSync.

For the most part, the conduit operates in the background, without the users knowledge of it ever being there. However, should any changes in conduit behavior be made, it can be made in the HotSync manager application. The following is the dialog box that selects conduit behavior.

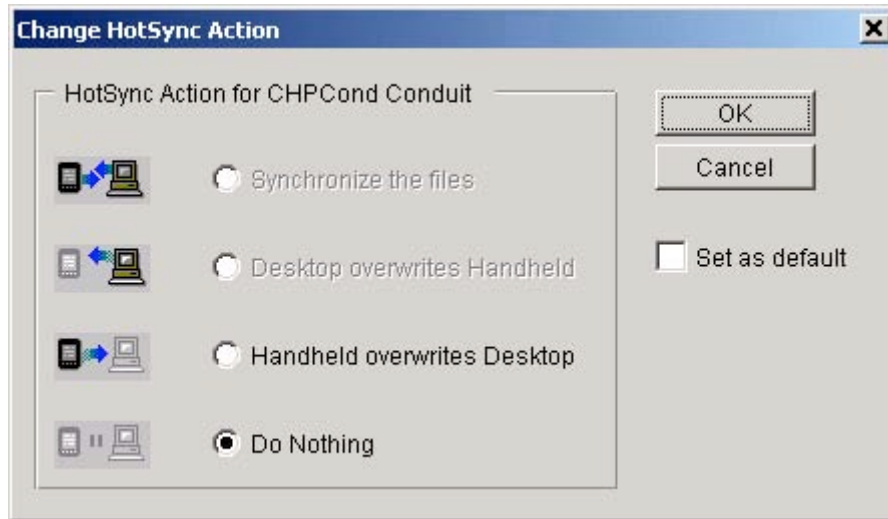


Figure 9: Dialog box controlling conduit behavior

Java Server Application

This application was developed with the intent of emulating the behavior of existing CHP software. It was designed to communicate wirelessly with the Palm OS Application through the hardware architecture described in section 5.1 of this report. The Java Server Application resides in the Laptop or mobile computing device.

Currently, the software acts like a server, listening for incoming TCP/IP communication on a particular port. It has been hard-coded as port '1500'. This port value can be changed as necessary. It receives incoming data packets on the designated port and responds accordingly. For example, if a License Plate Number were transmitting on port 1500, the server would pick it up and respond with detailed information about that plate. A screenshot of the application follows.

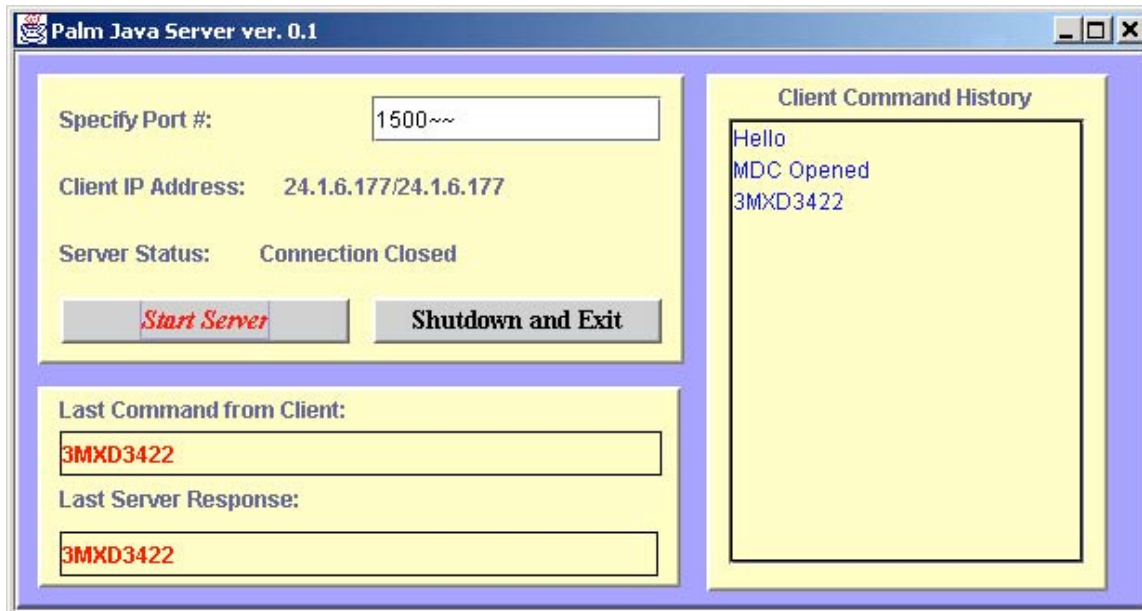


Figure 10: Java Server Application screenshot. Any incoming data packets received will be echoed in the Client Command History. The IP address of the sender is also noted.

Installation Suite

An installation suite akin to the Installshield suites used by a predominate amount of commercial software was developed to automate installation of the Palm OS Application and installation of the Java Conduit. Such a automated suite is necessary given the technical complexity involved in installing and configuring a Java based conduit in a client's computer. The installation suite is packaged in a single executable file. The user is guided throughout the entire installation process.

The installer was created by Ghost Installer, a freely available development software for installation suites available at <http://www.gInstall.com>. Installshield was a possible alternative, but was eliminated since its software required license purchasing.

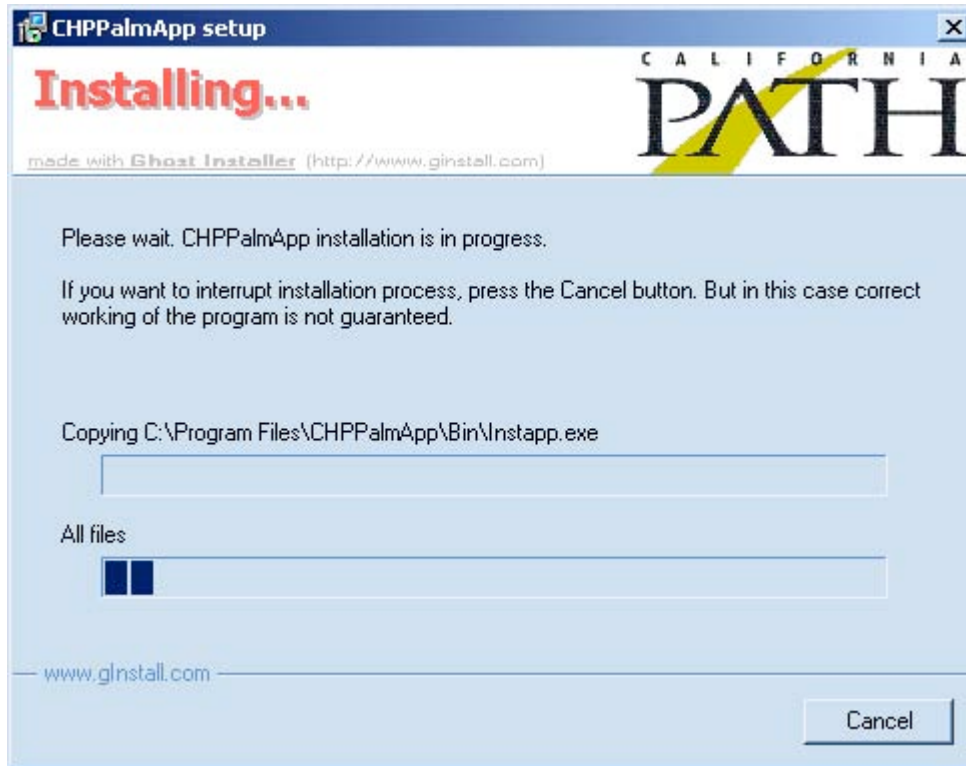


Figure 11: Installation suite in action.

The automated installation process is governed by a user created scripting file with XML elements. The installation process is as follows:

1. License agreement
2. Selection of Installation directory, type, and program group.
3. Installation of program files.
4. Registry updates
5. Jsync installation
6. Queuing of Palm OS Application (load PRC file into HotSync Manager)
7. Restart HotSync (required for changes to take place)

6.0 Conclusion

In this report, we described the development process of an application tool that is intended for the use by law-enforcement officers. The application tool is targeted for information gathering at traffic accident scenes. The potential benefits lie in the resultant reduction of incident documentation time, and thus leading to a faster scene restoration, traffic resumption, and reduced congestion caused by roadway incidents or collisions.

During the development of this tool, we have seriously considered the real-world concerns of users and communicated through several channels to ensure the desirable features are

implemented properly. The focus was placed on the time saving and user-friendly requirements that are absolutely necessary for the tool's intended use. Initial efforts have resulted in a functional module that possesses text and graphics entry options, menu-driven displays, and a report retrieval database.

Since the mobile platform is conceived as an integral component of an incident documentation system, it is structured adaptively for additions of other input and communication devices. The flexibility in the functionality of the tool presents a great potential to be used as a stand-alone module or to be coupled with expanded functions. As mentioned earlier, the usability of the basic application can be greatly enhanced by integrating input devices with the mobile platform. These remain the topics of future work.

In the implementation described in this report, the tools that were used, such as the wireless devices, and the software options, such as operating systems and display presentations, were all adopted from the commercially available products. As a result, we demonstrated that an integration of commercial-off-the-shelf products can be a successful approach for the developments of incident handling tools. On the other hand, we should also realize that the evolution of hardware and software products occur very quickly. Therefore at any stage of deployment, extensive search and thorough evaluation of latest developments in related areas should be conducted. For example, the use of Bluetooth or other 802.11 devices are in an explosive phase of commercialization in the market phase. Further yet, handheld computers or cell phones containing digital cameras, voice recorders, or other relevant functionality will be readily available. Devices that provide additional features and cost-effective options will prove to be more powerful and suitable choices for those tools deployed by future studies.

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6. <http://www.gInstall.com>
7. <http://www.palmos.com/dev/tech/conduits/>
8. Palm OS Programmer's API Reference
9. Palm OS Programmer's Companion Vol. 1, Vol. 2

Appendices (contained in CD)

- A. Powerpoint of palm screen images
- B. Conduit file formatting
- C. Powerpoint of project overview

Appendix A

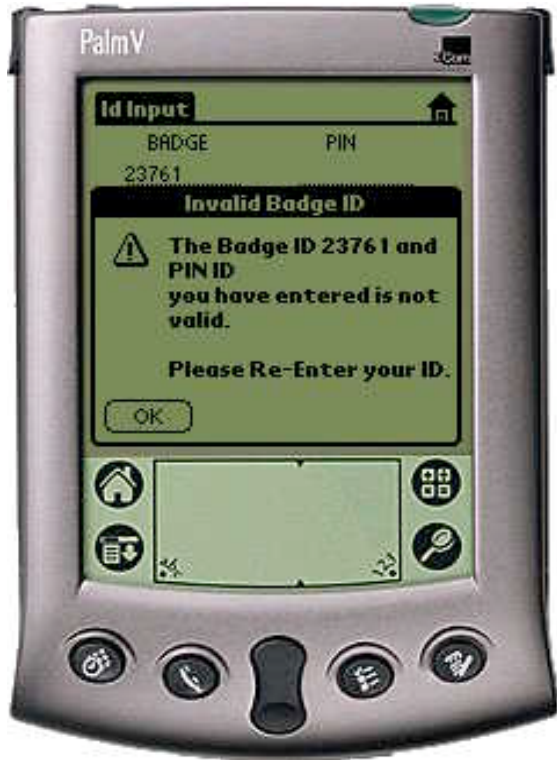
Login



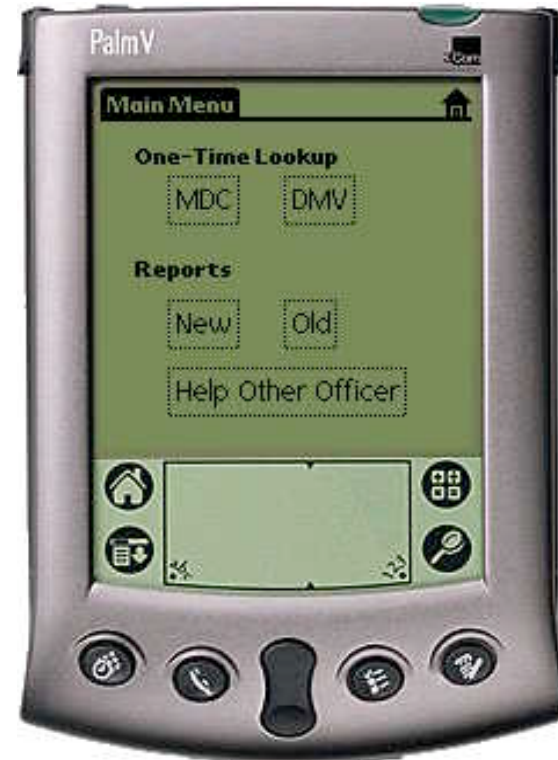
User ID Input



Invalid ID Input



Main Menu



New Report



CALIFORNIA
PATH

Saved Reports



CALIFORNIA
PATH

Report Title



Time and Date



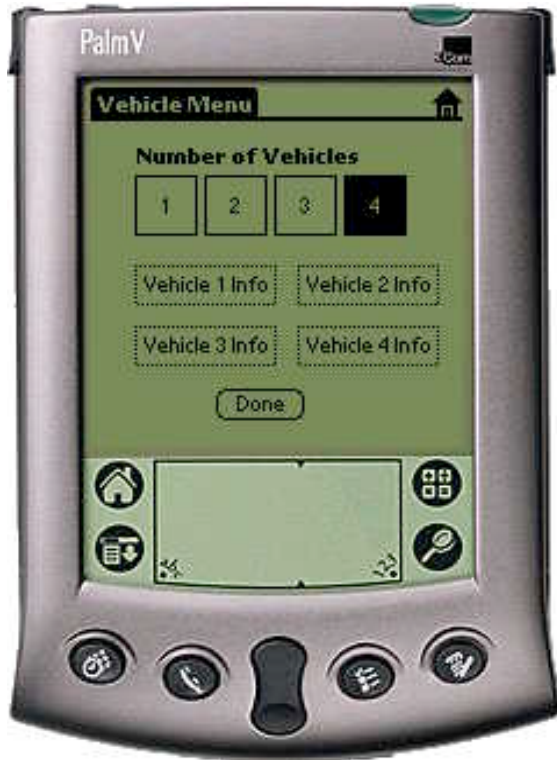
Time Select



Date Select



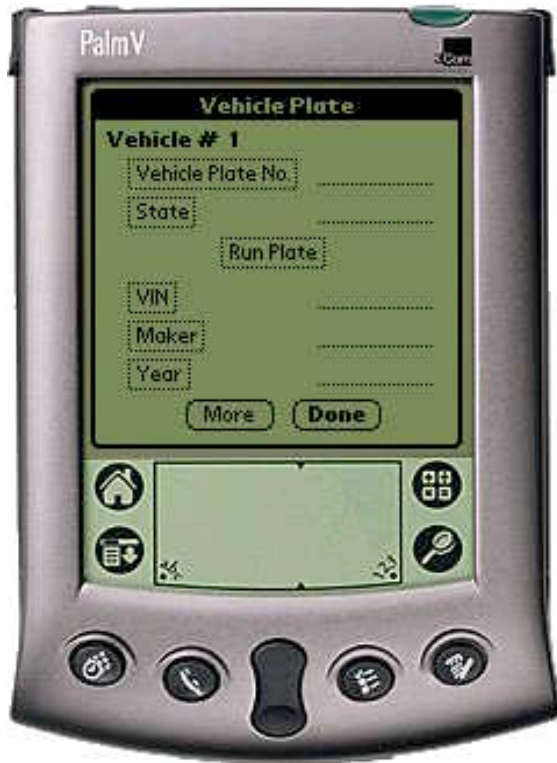
Vehicle Menu



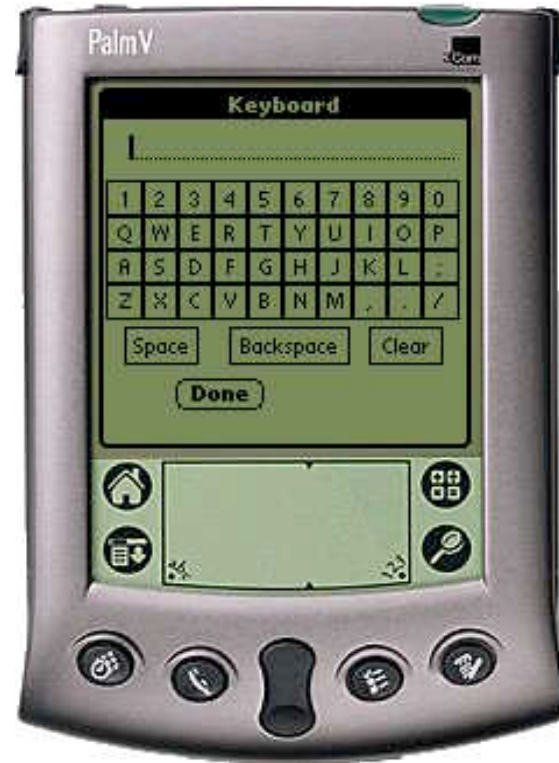
Vehicle Type



Vehicle Plate



Keyboard



Vehicle Damage



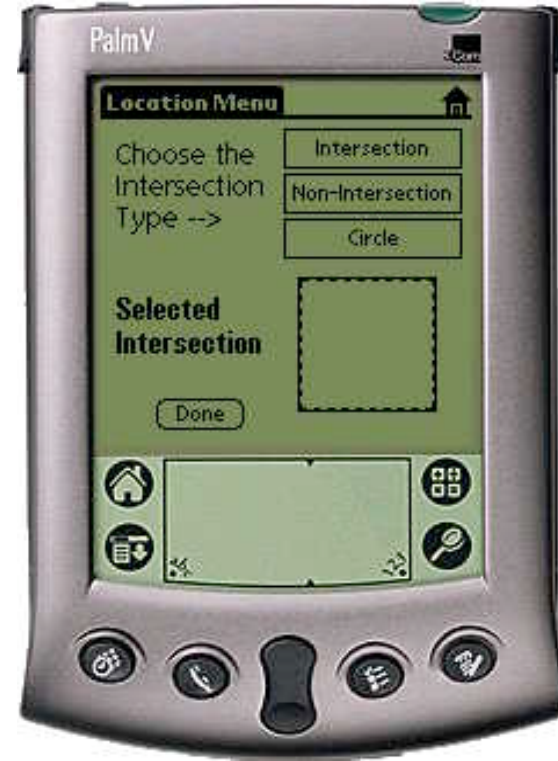
Peoples Menu



Driver / Witness Information



Location Menu



Intersection



Non-Intersection



Incident Information



Vehicle Conditions



Seating Position



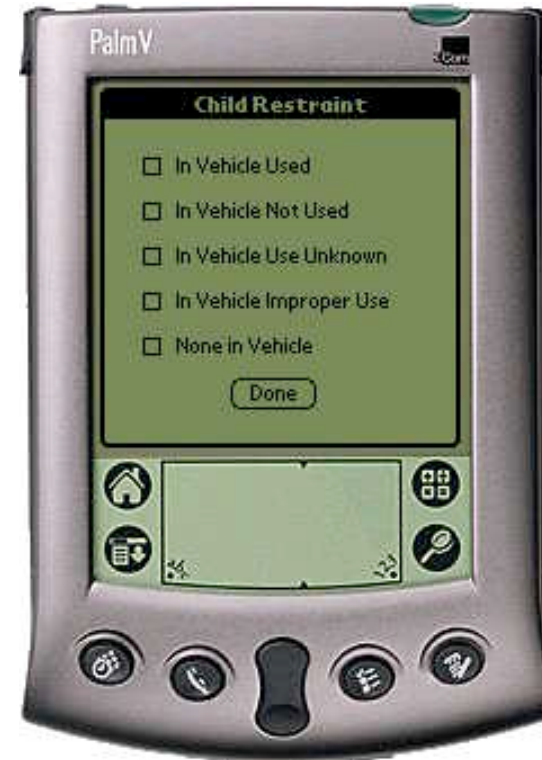
Safety Equipment



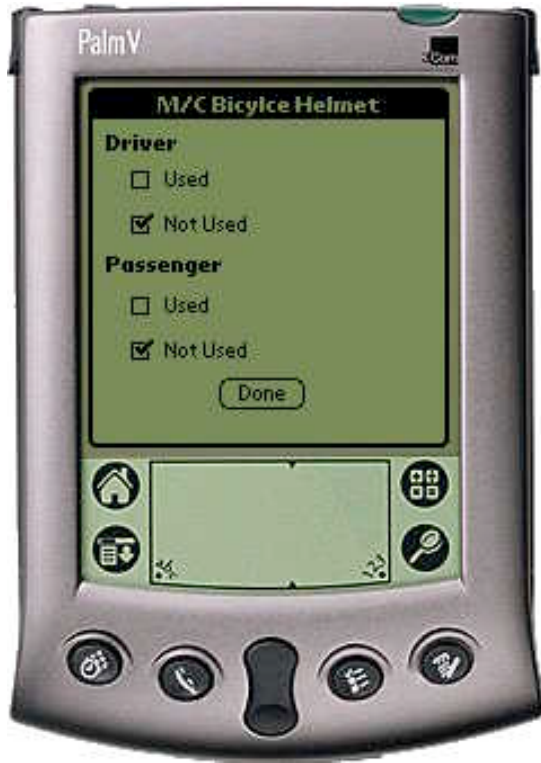
Occupants – Safety Equipment



Child Restraint



Motorcycle / Bicycle Helmet



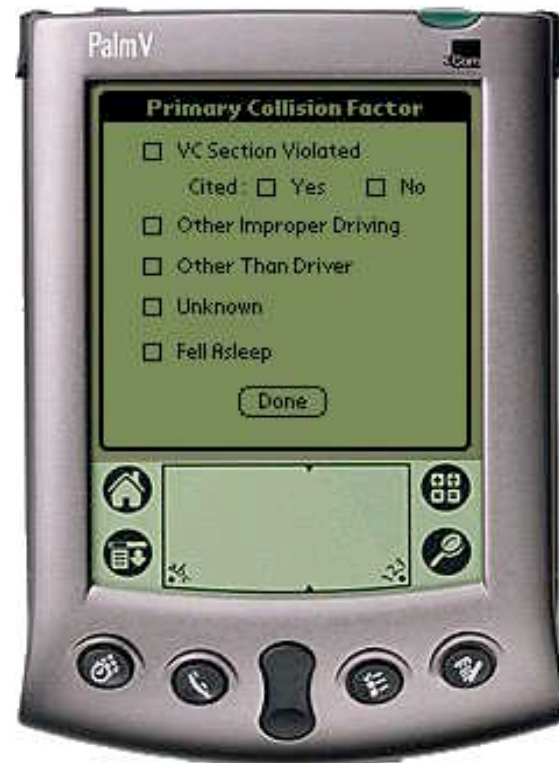
Ejected From Vehicle



Environmental Conditions



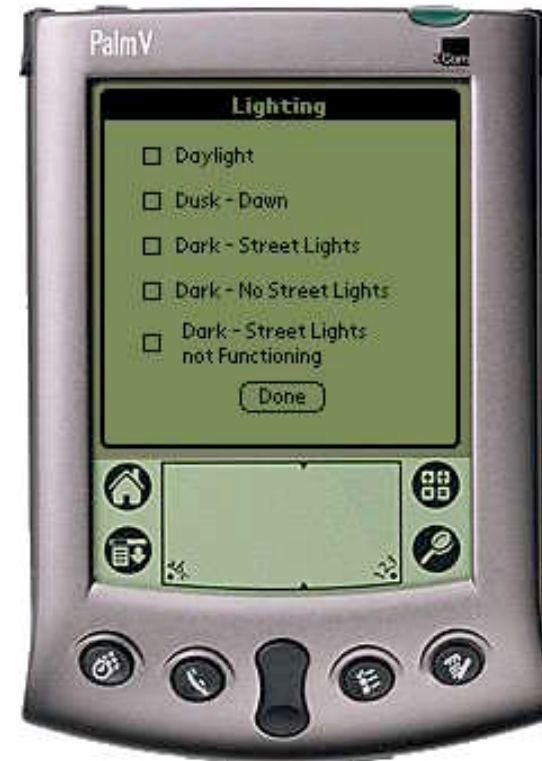
Primary Collision Factor



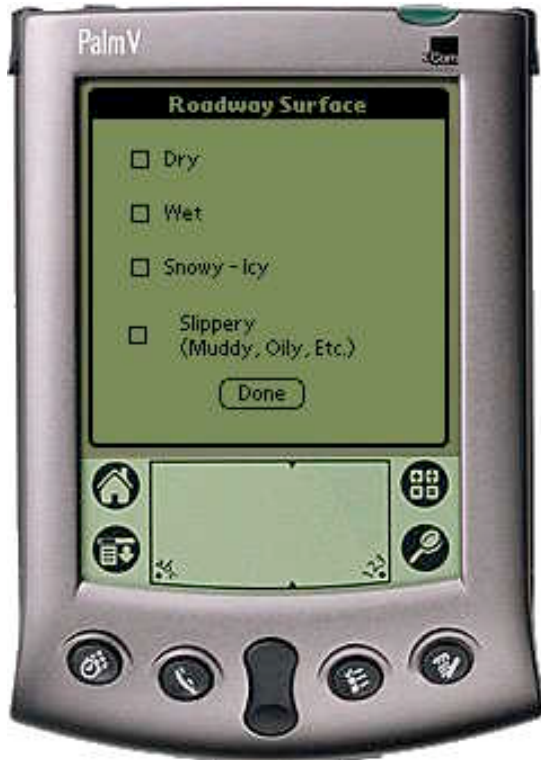
Weather



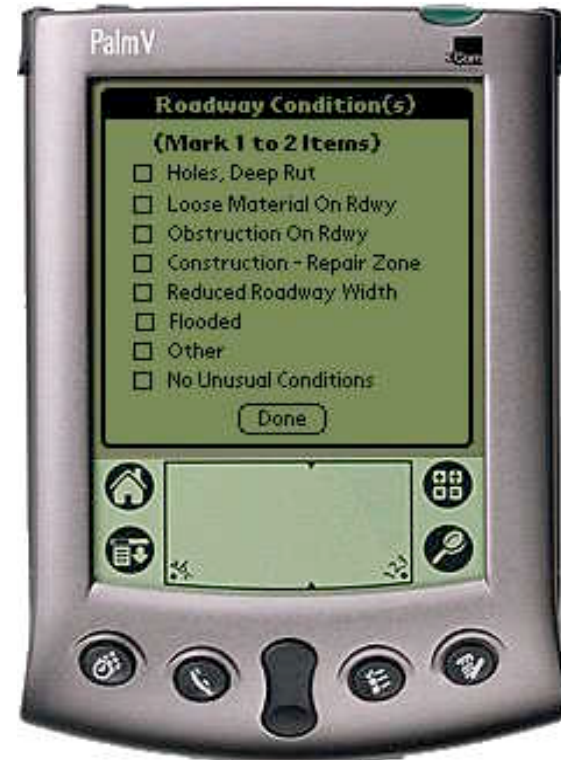
Lighting



Roadway Surface



Roadway Conditions



Appendix B

Conduit File Export Formatting

The below sample output is one report record taken directly from the file output created by the Palm Hotsync Conduit.

Sample Output

```
Report record: {
Category: 1   NumVehicles: 4   VehicleType: - 1 - 0 - 0 - 0   VehicleDamage: - 0
- 1 - 0 - 0 - 0 - 1 - 0 - 1 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0
- 0 - 0 - 0 - 0   NumDrivers: 4   NumWitness: 4   Intersection: 10
VehicleCond:
SeatingPos: - 1 - 0 - 1 - 1 - 0 - 1 - 1   SafetyEquip: - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0
ChildRestraint: 0   Helmet: - 0 - 0   Ejected: 0
EnvironCond:
CollisionFactor: - 0 - 0   Weather: 0   Lighting: 0   RoadSurface: 0
RoadCond: - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0
Title: Arrest 11/2/01 0:14   Date: Fri Nov 2, 2001   Time: 12:12 am
Vehicle1: PlateNo: RAY   State: Ca   VIN: 9779   Maker: Toyota   Year:
1992
Vehicle2: PlateNo: JENNY   State: Ca   VIN: 9779   Maker: Toyota   Year:
1992
Vehicle3: PlateNo: NORM   State: Ca   VIN: 9779   Maker: Toyota   Year:
1992
Vehicle4: PlateNo: TED   State: Ca   VIN: 9779   Maker: Toyota   Year:
1992
Driver1: First: PAUL   Last: MO   License: 32MWD3233
Driver2: First: TIP   Last: last name   License: 32MWD3233
Driver3: First: GGH   Last: last name   License: 32MWD3233
Driver4: First: GDRDF   Last: last name   License: 32MWD3233
Witness1: First: first name   Last: last name   License: 32MWD3233
Witness2: First: first name   Last: last name   License: 32MWD3233
Witness3: First: first name   Last: last name   License: 32MWD3233
Witness4: First: first name   Last: last name   License: 32MWD3233
}
```

***All data fields are hyperlinked to web pages showing the origin of the stored data field.

A space separates the field name and field data.

A tab separates the field name + field data.

i.e. "FieldName: fielddata FieldName: fielddata"

What the data means

- Category : Represents the type of report generated.
 - Not yet implemented.

- NumVehicles : number of vehicles in the report
- VehicleType : type of vehicle
 - 4 numbers
 - each number represents the type of vehicle
 - 0 – none selected
 - 1 – Passenger Car
 - 2 – Small Truck
 - 3 – Mid-Size Truck
 - 4 – Tractor Trailer
 - 5 – Bus
- VehicleDamage
 - 32 numbers
 - 4 groups of 8 numbers representing vehicle damage area
 - Number 1-8 indicates damage for vehicle 1
 - Number 9-16 indicates damage for vehicle 2
 - Number 17-24 indicates damage for vehicle 3
 - Number 25-32 indicates damage for vehicle 4
 - 0 – no damage
 - 1 – has damage
- NumDrivers : number of drivers in the report
- NumWitness : number of witness in the report
- Intersection : indicates the type of intersection
 - 1 number
 - 0 – none selected
 - 1 – Four way Intersection
 - 2 – Four way slanted
 - 3 – Six Way Slanted
 - 4 – T Intersection
 - 5 – T Slanted Intersection
 - 6 – Two T Slanted Intersection
 - 7 – Straight Non-Intersection
 - 8 – Curve left Non-int
 - 9 – Curve Right Non-int
 - 10 – Circle Intersection
- SeatingPos : the seating position of the vehicle
 - 7 numbers, each representing a seat in the vehicle
 - 0 – not seated
 - 1 – is seated
- SafetyEquip: safety equipment used in the car
 - 0 – not selected
 - 1 – selected
- Child Restraint:
 - See palm page
- Helmet :
 - 2 numbers (driver, passenger)
 - 0 – used

- 1 – not used
- Ejected :
 - See palm page
- CollisionFactor :
 - See palm page
- Weather :
 - Values range from 1-7
- Lighting :
 - Values range from 1-5
- RoadSurface :
 - Values range from 1-4
- RoadCond :
 - 8 numbers
 - 0 – not selected
 - 1 – selected.

Appendix C

A Mobile Platform for Highway Incident Documentation

**C-Y Chan, Ray Su, Dave Nelson, Paul
Kretz**

California PATH

A. Steinfeld

Carnegie Mellon University



CYC@ITSWC02.ppt 1

Problems to be Addressed

- 1. Incidents lead to traffic congestion and delays**
- 2. Law enforcement officers work in a stressful and dangerous environment**



CYC@ITSWC02.ppt 2

Severity of Problems

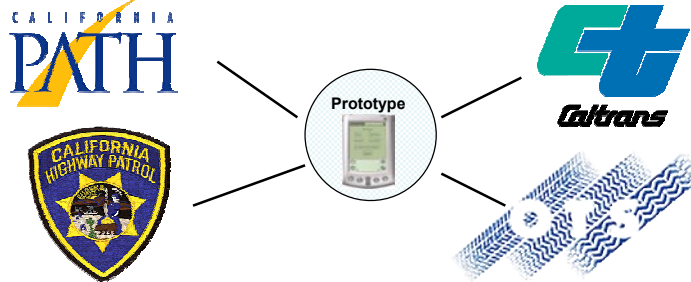
1. In 2000, the state of California had a total of 511,248 collisions: 3,331 fatal, 198,348 injuries, 309,569 property damage only.
2. Other types of incidents, such as traffic violations or stopped vehicles, can also lead to slowed or stopped traffic and highway congestion.



Potential Benefits

1. Law enforcement officers can benefit from using well-designed hardware/software tools to save time in the field while documenting these incidents.
2. Even if limited to a partial numbers of all applicable incidents and a saving of a few minutes for each case, the overall saving in time and potential reduction of traffic congestion is enormous. (250,000 incidents x 1 minute/case \approx 4,000 hours)

Project Background



1. **Sponsor: California Office of Traffic Safety (OTS).**
2. **Fund Recipient: California Department of Transportation (Caltrans).**
3. **Sub-Contractor: PATH**
4. **Customer and Collaborator: California Highway Patrol (CHP).**



CYC@ITSWC02.ppt 5

Project Goals and Objectives

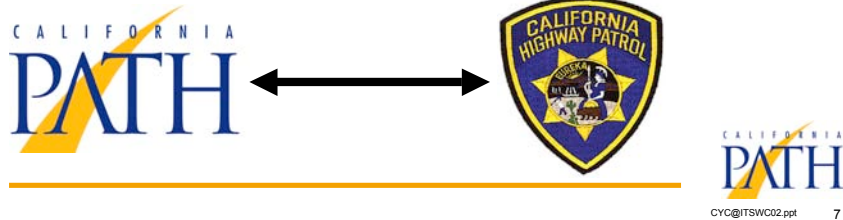
- To develop software/hardware tools to be used for documenting and analyzing vehicle collisions and traffic incidents.
- To lighten the working loads of California Highway Patrol officers.
- To reduce incident-handling time and ultimately ease traffic congestion.



CYC@ITSWC02.ppt 6

Discussions and Feedback from CHP

- Safety of officers on the scene is priority #1.
- Time saving is valuable; easy data entry is key.
- Compatibility of data format with other CHP applications is critical.
- Magnetic card reader or bar code reader to expedite the documentation process will be useful.
- Other equipment being discussed include GPS, voice recorder, optical range finder, digital camera, finger print device, etc.



Desired Features

- Time Saving
- Ease of use
- Smooth data transfer
- Flexibility in function division
- Flexibility in integration with other hardware and software and future expansion

Conceptual System Architecture

Existing CHP Equipment and Platform



Potentially Appending Input Devices

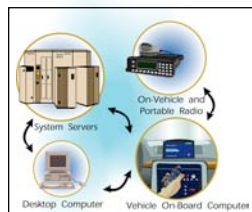


Basic Mobile Platform in Development

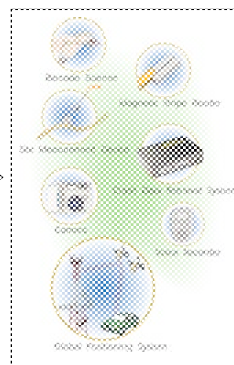


Conceptual System Architecture

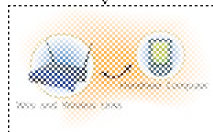
Existing CHP Equipment and Platform



Potentially Appending Input Devices



Basic Mobile Platform in Development

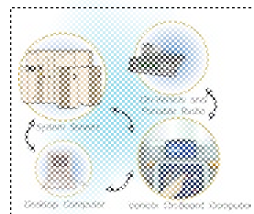


Existing Equipment and Platform

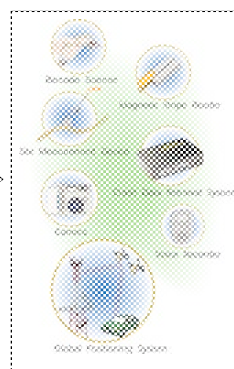


Conceptual System Architecture

Existing CHP Equipment and Platform



Potentially Appending Input Devices



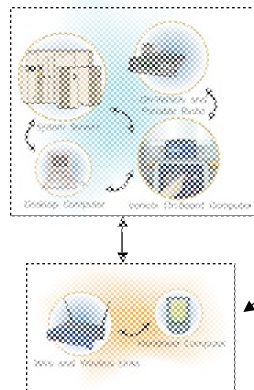
Basic Mobile Platform in Development

Basic Mobile Platform in Development



Conceptual System Architecture

Existing CHP Equipment and Platform



Basic Mobile Platform in Development

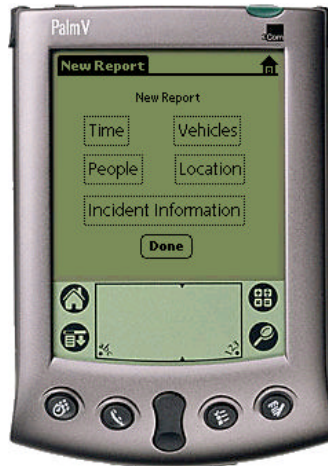
Potentially Appending Input Devices



Potentially Appending Input Devices



Basic Software Development



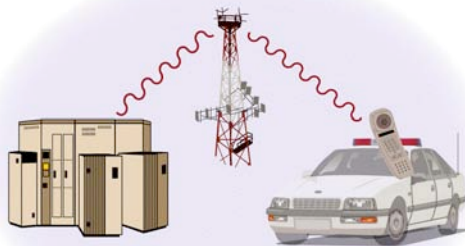
Remote Access and Connectivity

- Enabling a remote connection for inquiry and data access while CHP officers are roaming at incident scenes
- Demonstrated wireless connection with networking devices based on IEEE 802.11b standard
- Commercial off-the-shelf product
- Future implementation will depend on the selection of service network and handheld choices by law enforcement agencies



Remote Access and Networking

- Future deployment will probably be based on a cellular phone/handheld computer combination.
- The hardware with built-in software will communicate with the dispatcher and data network directly to allow efficient data transfer.



Concluding Remarks

1. The project was carried out to explore tools for the use of law enforcement officers to expedite incident documentation.
2. A mobile platform based on a handheld computer is an ideal device.
3. Users requirements and desired features are gathered through extensive communication between the developer (PATH) and the users (CHP).
4. A basic version of incident documentation software and related communication has been successfully developed.
5. Future developments will lead to a more efficient and more user-friendly tool, with the eventual benefits of reducing highway congestion.

Future Work

1. Developing preliminary photo-grammetry software tool.
2. Joining IEEE 1616 MVEDR (Motor Vehicle Event Data Recorder) Committee and Working Group to understand and explore latest developments of “black box” on vehicles.
3. Similar developments for Caltrans-Oriented Applications?
4. Implementation and deployment plan for CHP use, if desired:
 - Must fit into overall planning of CHP software/hardware strategies
 - Will require thorough evaluation process to render prototypes into production-grade software
 - Will need a process of integration team work with CHP and PATH participating