


## Paper Session II: Forensic Scene Documentation Using Mobile Technology

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# **Forensic Scene Documentation Using Mobile Technology**

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## **Abstract**

This paper outlines a framework for integrating forensic scene documentation with mobile technology. Currently there are no set standards for documenting a forensic scene. Nonetheless, there is a conceptual framework that forensic scientists and engineers use that includes note taking, scene sketches, photographs, video, and voice interview recordings. This conceptual framework will be the basis that a mobile forensic scene documentation software system is built on. A mobile software system for documenting a forensic scene may help in standardizing forensic scene documentation by regulating the data collection and documentation processes for various forensic disciplines.

Keywords: Forensic Scene Documentation, Mobile Technology in Forensics, Standard Forensic Scene Documentation, Forensic Software, Engineering Forensics, Forensic Science.

## **1. INTRODUCTION**

Forensic scene documentation is the most important step in the processing of the forensic scene [1]. The purpose of documenting the scene is to record the condition of the scene and its physical evidence. Documenting a forensic scene is “The most time-consuming activity at the scene and requires the investigator to remain organized and systematic throughout the whole process” [1][11].

Forensic scene documentation has not been emphasized on rigorously in forensic practice. There are no set standards for forensic engineers and crime scene investigators to follow when documenting a scene. The knowledge about forensic scene documentation has been assembled by different experts in the field due to their extensive work experience in forensics.

The forensic disciplines are improving continuously as new ways of analyzing forensic evidence keep emerging. Many improvements are being credited to Information Technology (IT) in analyzing forensic evidence and data. It makes sense though, that documenting the data is a crucial step that needs to be performed before the data is analyzed.

The researcher believes that forensic scene documentation’s importance has been miss-weighted in the minds of forensic professionals. It seems that this step is somewhat ignored, and ways to improve scene documentation are not fully discussed, making forensic scene documentation a non-standardized process, and forcing that process to be lacking in content and efficiency.

To ameliorate the subject of forensic scene documentation the author chose the newly hyped IT concept of mobility. After the researcher’s experience and consultation with IT experts in the area of mobile software development, mobility seemed like a good technology candidate for the use in data collection at a physical scene. This notion mirrored the idea of forensic scene documentation since it mainly constitutes data recording and gathering.

## **2. SIGNIFICANCE OF THE PROBLEM**

There are numerous reasons why the current system in forensic scene documentation is flawed. The first and perhaps the most important reason why this area in forensics should be studied is due to the lack of standardization of processes in forensic scene documentation.

By consulting two experts in the field of forensics– Professor Dewitt at the Purdue University department of Electrical Engineering Technology, who is a practicing forensic engineer and Dr.

Marcus Rogers at the Purdue department of Computer Technology with a PhD in Forensic Psychology, the researcher was able to gain some face validity on the subject matter. Both experts agreed that there was no standardized process for forensic scene documentation. This portrayed the importance of the subject under discussion. Additionally, it illustrated the lack of organized knowledge base in that subject matter.

To exemplify the importance of standardization of processes when documenting a forensic scene, think of the following situation. Imagine two different forensic investigators working on the same case for opposite parties, and both of them arrive at different conclusions. How can their results be comparable if their methods of documenting the scene were different? This is one of the biggest problems that the lack of standardization for forensic scene documentation can cause.

By attempting to tie in mobility to forensic scene documentation, the researcher intends to create a standard framework that forensic professionals can use through mobile software when documenting a forensic scene.

### 3. WHY CONSIDER MOBILITY?

Mobility is a hyped concept in IT. The researcher found one main study that was conducted illustrating the extent to which people depend on mobility. In that study performed by Telecomy Research titled “Me, My Mobile and I”, a study of 1,400 mobile users revealed that people born in the mobile generation treat mobiles as life support devices [3]. This greatly complimented the idea of using mobility in forensics as a mobile tool for forensic scene documentation, showing that mobility is slowly becoming part of everyone’s lives.

The research findings classified mobile users into different categories. The first one was the M-Agers. The paper stated “M-Agers are children aged between 10 and 14, were born into a time where mobile phones use was common place and have subsequently developed a significant emotional attachment to their phone using it for much more than communication” [3]. The second group revealed by the study was referred to as the “Denier group”. The paper declared that the Denier group “Believe themselves to be unattached to their mobile seeing it as useful with some respondents stating they only switch it on when necessary.”[3]. Furthermore it was explained that “Despite their apparent lack of emotional attachment towards their mobile, Deniers demonstrate a great fear of losing it suggesting the device means more to them than they’re willing to concede. 18% of the sample claimed they were not attached to their mobile but displayed characteristics of not being able to live without it.” [3]. The research findings are exemplified in Table I.

TABLE I  
Me, My Mobile and I Findings [3]

Finding number	Research Findings
Research Finding 1	Users ‘can’t live’ without their mobile: 26% of respondents stated they couldn’t live without their mobile demonstrating the huge part the mobile plays in our everyday life
Research Finding 2	Denial amongst UK mobile users: 18% of UK mobile users refuse to admit the importance of the mobile in their life, but are incapable of functioning without it
Research Finding 3	Mobiles ‘author’ our lives: Mobile phones are becoming vitally important in managing the huge volume of information we receive on a daily basis and begin to replace address books, diaries, watches, alarm clocks and even land-line telephones amongst the mobile public
Research Finding 4	Businesses missing opportunities: Businesses are missing great opportunities to market products and services to users via their mobile in ‘interspace’ – the time and space between events and arrangements
Research Finding 5	Mobiles used as ‘virtual’ transport: Whilst children use mobiles to play games and transport themselves to a ‘virtual playground’, adults use the mobile as a ‘virtual friend’ to interact with whilst there’s a gap in their life

“Me, My Mobile and I” illustrated the importance of mobility for growing generations.

#### 4. MAJOR FRAMEWORK USED IN FORENSIC SCENE DOCUMENTATION

There are different ways in which a forensic scene is documented. After a concrete review of different literature, five major items a forensic professional would perform when documenting a forensic scene, were identified. These items are illustrated in Table II.

The items in Table II, aid in formulating a framework for forensic scene documentation. It is important to note that different forensic disciplines might require other items when documenting a scene. For example, an expert in fires and explosions might consider different items when documenting a forensic scene when compared to an expert in digital forensics. The main framework the author proposes will be illustrated in the “*Proposed Mobile Software Framework for Forensic Scene Documentation*” section.

Table II

Major Framework for Documenting a Forensic Scene

Framework parts
<ul style="list-style-type: none"> <li>• Note taking at the forensic scene</li> <li>• Video taping the forensic scene</li> <li>• Photographing the forensic scene</li> <li>• Sketching the forensic scene</li> <li>• Recording vocal interviews with people that were present at the forensic scene</li> </ul>

#### 5. NOTE TAKING AT THE FORENSIC SCENE

Note taking is an item that was mentioned in different literature found. It is important for any investigator to write notes while documenting a forensic scene so that the information would not be forgotten.

Under Section C, in “Fire and Arson Scene Evidence” [3], provided by the United States (US) Department of Justice (DOJ), subsection two was labeled “Describe and Document the Scene”. The principle behind that sub section was that “Written documentation of the scene provides a permanent record that may be used to refresh recollections, support the investigator’s opinions and conclusions, and support for photographic documentations” [3]. The procedure included four steps that are portrayed in Table III.

Table III

Department of Justice Procedures for Describing and Documenting the Scene [3]

Documenting the scene procedures
<ul style="list-style-type: none"> <li>• Prepare narrative, written descriptions and observations, including assessments of possible fire causes</li> <li>• Sketch an accurate representation of the scene and its dimensions, including significant features such as the ceiling height, fuel packages, doors, windows and any areas of origin</li> <li>• Prepare a detailed diagram using the scene sketch(es), preexisting diagrams, drawings, floor plans, or architectural or engineering drawings of the scene. This may be done at a later date</li> <li>• Determine whether additional documentation resources are necessary</li> </ul>

In another guide provided by the US DOJ called “A Guide for Explosion and Bombing Scene Investigation”, section D, part one was titled “Documenting the Scene” [4]. The principle behind that section was “The investigator will prepare written scene documentation to become part of the permanent record” [4]. The procedure included five steps which are portrayed in Table IV.

Table IV

Department of Justice Procedures for Documenting the Scene [4]

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Documenting the scene procedures

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- Document access to the scene
- Document activities, noting dates and times, associated with the incident and the investigation
- Describe the overall scene in writing, noting physical and environmental conditions (e.g., odors, weather, structural conditions)
- Diagram and label scene features using sketches, floor plans, and architectural or engineering drawings
- Describe and document the scene with measuring equipment, which may include surveying equipment, Global Positioning System (GPS) technology, or other available equipment

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The literature review then led the researcher to forensic engineering literature [5]. It was explained in that literature “Throughout the entire field investigation, the investigator needs to take accurate, copious notes. In addition to a trained eye, a pad and a pencil may be the second most important tools that an investigator brings to the site” [5]. The literature also stated that the information recorded should include what is apparent in Table V.

Table V

Forensic Engineering Note Taking [5]

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Note taking information to be recorded

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- The name of everyone who was present at the site during the investigation
- The recording devices examined and the data obtained from them
- Gridded measurements of the site
- Sketches of all parts involved in the incident, including missile maps with key reference points
- A list of all visual documentation, such as the number of film reels or cartridges
- All field tests that were performed on labeled structures and parts and the results of those tests
- All photographs and all pertinent identifying information on equipment or parts
- Sketches of the field parts and fracture surfaces and observations about failure sites, contamination, degradation, and primary and secondary deformation

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In another literature review finding, that is more involved with crime scenes [1], the author explained “Effective notes as part of an investigation provide a written record of all the crime scene activities. The notes are taken as the activities are completed to prevent possible memory loss if notes are made at a later time” [1]. The author also stated that the general guideline for not taking is to consider who, what, when, why, and how and should particularly contain the items apparent in Table VI.

Table VI

Crime Scene Investigation Note Taking [1]

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Note taking information to be recorded

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- Notification information: This includes date and time, method of notification, and information received
- Arrival information: Means of transportation, date and time, personnel present at the scene, and any notifications to be made
- Scene description: Weather, location type and condition, major structures, identification of transient and conditional evidence (especially points of entry), containers holding evidence of recent activities (ashtrays, trash cans, etc.), clothing, furniture, and weapons present
- Victim description: In most jurisdictions a body should not be moved or disturbed until the medical examiner has given approval, after which notes can be made of position, lividity, wounds, clothing, jewelry, and identification
- Crime scene team: Assignments to team members, walk-through information, the beginning and ending times, and the evidence-handling results

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The literature examined illustrated that experts from different forensic disciplines have similar points of views on note taking when documenting a forensic scene. Some authors chose to integrate sketches into note taking; however, the researcher chose to separate those two items, especially when considering them as two different parts of a mobile software system.

## 6. VISUAL DOCUMENTATION OF THE FORENSIC SCENE

Visual documentation of a forensic scene is very important. Engineering literature examined as it stated “If litigation is involved, visual documentation is usually presented to the jury. For this reason, videotape is receiving more and more attention. It is a medium that judges, juries, attorneys, and experts are familiar with” [5].

Visual documentation can play a crucial role in convincing the jury. With the aid of digital cameras, video taping and photography at a crime scene are becoming easier and cheaper to perform. There are certain steps that should be followed before visually documenting the forensic scene. These steps are shown in Table VII.

Table VII  
Forensic engineering Visual Documentation [5]

What an investigator should do before visual documentation
<ul style="list-style-type: none"><li>• Review the information obtained from eyewitnesses</li><li>• Make a grid map, pace off the site, and note the location of fixed structures, markers, and reference points as well as the structure and the equipment involved in the incident</li><li>• Measure the reference points and the location of parts</li><li>• Set up an indexing system for identifying objects that will appear in the photographs or video recordings</li><li>• Look for means of identifying equipment (e.g., serial numbers)</li></ul>

Items in Table VII were aimed at forensic engineers. However, similar ideas are used when performing any crime scene investigation as well. There are two concepts that forensic professionals seem to use when visually documenting a scene which are 1) Photography and 2) Videotaping.

### 6.1 Photography

Photography has become much easier over the past decade with the use of digital cameras. No longer does a forensic investigator have to carry numerous rolls and cartridges to document the scene with enough pictures. Information Technology has truly ameliorated the process of forensic photography making it faster, better and cheaper. There are things that should be mentioned about photography in order to make the mobile software aware of existing expert opinions on photography.

In a crime scene investigation literature it was stated, “The purpose of still photography documentation of the crime scene is to provide a true and accurate pictorial record of the crime scene and physical evidence present” [1]. This provides investigators with a permanent record of the scene, for legal purposes. Yet, there are certain guidelines for taking photographs at a forensic scene.

The guideline proposed in crime scene photography explains that when taking a photograph, a forensic professional should always go from general views, to midrange views, to close-up photos. The guidelines for photographing a crime scene are illustrated in Table VIII.

It is significant to mention that crime scene investigation literature explained “Every photograph taken at a crime scene must be recorded in a photo log. The log should show the time and date the photograph was taken, the roll number, the exposure number, the camera settings, indication of distance to the subject, the type of photograph taken and a brief description” [1].

TABLE VIII  
Guidelines for Photographing a Crime Scene [1]

Type of Photo	Guidelines for Photography
<b>Overall</b>	<b>Exteriors:</b> Surroundings; buildings and major structures; roads and paths of travel into or away from scene; street signs and survey markers, mail boxes and address numbers, take aerial photographs when possible photograph before 10 a.m. or after 2 p.m. if possible. <b>Interiors:</b> Use the four compass points or room corners as guides; take overlapping views; doors leading into and from structural use tripod in low light situations for increased depth of focus concerns
<b>Midrange</b>	Follow a stepwise progression of views; use various lenses or change the focal length of the lens to achieve a “focused” view of the individual items of evidence within the original view of the crime scene add flash lighting to enhance details or patterned evidence
<b>Close-up</b>	Use documentation placards; detach flash from camera; use proper side lighting effects fill in with flash when harsh shadows are present take photos with and without scales
<b>All</b>	Record in log use camera setting that achieve good depth of focus; no extraneous objects like team members, equipment, feet or hands change point of view; be aware of reflective surfaces; when in doubt, photograph!

The other literature that was found on photography was mainly geared towards forensic engineering. Most of the sections on photography also included videotaping the scene. The researcher chose to split those into two entities because they are two different items from an application development perspective.

## 6.2. Video Taping

A newer form of forensic scene visual documentation includes videotaping. This form of documentation is also improving with the aid of IT. Nowadays, digital cameras can take excellent quality video capture. No longer are numerous films and cartridges needed to videotape the forensic scene. However there are a number of recommendations that forensic professionals propose when videotaping a forensic scene.

The researcher used a combination of crime scene investigation and engineering forensics literature, and the process illustrated in Table IX was formulated to help when video taping a forensic scene [1]

TABLE IX  
Guidelines for Videotaping a Crime Scene [1]

Guidelines for forensic scene video taping
<ul style="list-style-type: none"> <li>• Video introduction. This should include                             <ul style="list-style-type: none"> <li>○ Case number</li> <li>○ Date and time</li> <li>○ Location</li> </ul> </li> <li>• Video should start with scene surroundings, should include roads to and from the scene</li> <li>• Video should then include a general orientation of the scene. The orientation of the items of evidence in relation to the overall scene                             <ul style="list-style-type: none"> <li>○ Again the general to close-ups method is used</li> <li>○ This should include a smooth transition from one item to another</li> </ul> </li> <li>• If there is a victim, the victim’s viewpoint should be taped</li> <li>• Camera techniques should be used to keep the taping clear (e.g. tripod, lighting effects)</li> <li>• Tapes should be reviewed when they are full to make sure everything needed was captured</li> <li>• The original taping should not be edited or altered and copies should be made as back ups</li> <li>• All video captures should be logged similar to photographic logs</li> <li>• The video can finally include any incident reconstruction efforts that would be difficult to perform in the court room</li> </ul>

## 7. SKETCHING THE FORENSIC SCENE

Sketching a forensic scene has no set standard or protocol. However, a number of literature findings indicated that a sketch should be a scaled down version of the scene. It should be systematic, should include all the evidence gathered, and at what locations the evidence was obtained. Furthermore, professor Dewitt of Purdue University indicated that the places where the photographs were taken should be indicated on the sketch.

There are usually two types of sketches, rough sketches and final sketches [1]. Rough sketches are the sketches that are drawn at the scene, final sketches are usually improved by using sketching software.

The literature found did not explain ways to sketch, making sketching a non-standardized process and mainly up to the forensic investigator's choice. This illustrated the importance of having software standardize the sketching process.

## 8. INTERVIEWS WITH VICTIMS AND WITNESSES

Only one of the literatures examined indicated the importance of interviewing victims and witnesses at the forensic scene. This perplexed the researcher, since interviewing the victims and witnesses is a crucial aspect of documenting a scene.

In the literature "A Guide for Explosion and Bombing Scene Investigation" released by the U.S. DOJ, under section D, subsection 3 "Locate and Interview Victims and Witnesses", the principle explained was "The investigator will obtain victims'/witnesses' identities, statements, and information concerning their injuries" [4]. Following the principle was a procedure that is portrayed in Table X.

TABLE X

Procedure for Interviewing [4]

Procedure for Locating and Interviewing Victims and Witnesses
<ul style="list-style-type: none"><li>• Identify and locate witness (e.g., victims who may have been transported, employees, first responders, delivery/service personnel, neighbors, passers-by) and prioritize interviews</li><li>• Attempt to obtain all available identifying data regarding victims/witnesses (e.g., full name, address, date of birth, work and home telephone numbers) prior to their departure from the scene</li><li>• Establish each witness' relationship to or association with the scene and/or victims</li><li>• Obtain statements from each witness</li><li>• Document thoroughly victim's injuries and correlate victim's locations at the time of the incident with the seat(s) of the explosions</li><li>• Interview the medical examiner/coroner and hospital emergency personnel regarding fatalities and injuries</li></ul>

It was also explained that cassette tapes should be used in order to record vocal interviews with the victims and witnesses. This process can be very time consuming if there were numerous victims and witnesses at the forensic scene.

## 9. HOW DOCUMENTING THE SCENE CORRELATES TO MOBILE DEVICES

The researcher chose two devices that he had an experience with to discuss with respect to mobile application development. These devices are the Tablet PC, and Personal Digital Assistant (PDA). The researcher intends to explain the advantages and disadvantages of using either a Tablet PC or a PDA for forensic scene documentation.



### 9.1. Tablet PC

“In general, a tablet PC is a wireless personal computer (PC) that allows a user to take notes using natural handwriting with a stylus or digital pen on a touch screen. A tablet PC is similar in size and thickness to a yellow paper notepad and is intended to function as the user's primary personal computer as well as a note-taking device. Tablet PCs generally have two formats, a convertible model with an integrated keyboard and display that rotates 180 degrees and can be folded down over the keyboard -- or a slate style, with a removable keyboard. The user's handwritten notes, which can be edited and revised, can also be indexed and searched or shared via e-mail or cell phone.” [6].

There are numerous advantages for using a Tablet PC as a platform to develop software that can be used to document a crime scene. There are also some disadvantages. The advantages and disadvantages are portrayed in Tables XI and XII. The advantages and disadvantages are explained in reference to the “*Major Framework for Documenting a Forensic Scene*” illustrated in Table II.

TABLE XI  
Advantages of Using a Tablet PC

Category	Advantages
<b>Note taking at the forensic scene</b>	<ul style="list-style-type: none"> <li>• A big screen, with a stylus (pen for writing)</li> <li>• Built in hand recognition software, so that all notes can be converted to typed textual format on the fly</li> <li>• Some Tablet PCs offer keyboard input, which can be used for note taking</li> </ul>
<b>Video taping the forensic scene</b>	<ul style="list-style-type: none"> <li>• If digital video taping is used on an external camera, it could be transferred to the Tablet PC using traditional computer transfer methods</li> <li>• Large disk space to fit large video captures</li> </ul>
<b>Photographing the forensic scene</b>	<ul style="list-style-type: none"> <li>• Built in digital cameras are available with a some Tablet PCs</li> <li>• If an external digital camera is used for better quality results, pictures can be transferred to the Tablet PC using traditional computer transfer methods</li> <li>• Pictures can be logged with textual input</li> </ul>
<b>Sketching the forensic scene</b>	<ul style="list-style-type: none"> <li>• Sketching is made possible with the stylus and screen</li> <li>• The almost paper size surface allows for a big enough sketch</li> <li>• A drag and drop sketching scheme can be used, meaning that preset images can be used (e.g. preset images for chairs, tables, rooms), to make sketching easier</li> <li>• GPS technology can be used in order to help map exact points and distances when sketching</li> </ul>
<b>Record vocal interviews with people that were present at the forensic scene</b>	<ul style="list-style-type: none"> <li>• Some Tablet PCs have built in microphones which can aid in recording interviews</li> <li>• Almost all Tablet PCs have an input for microphones if they do not have built-in microphones</li> </ul>
<b>General</b>	<ul style="list-style-type: none"> <li>• Easy to program for, just like programming for a Windows Operating System (OS), if Windows was used as an OS</li> </ul>

TABLE XII  
Disadvantages of Using a Tablet PC

Category	Disadvantages
<b>Note taking at the forensic scene</b>	<ul style="list-style-type: none"> <li>• It is not as natural to write on a Tablet PC as it is on paper</li> <li>• Hand recognition might not work well for everyone</li> <li>• It takes training and extensive use to get accustomed to using the stylus for input</li> </ul>
<b>Video taping the forensic scene</b>	<ul style="list-style-type: none"> <li>• Tablet PCs usually do not have digital cameras built into them</li> </ul>
<b>Photographing the forensic scene</b>	<ul style="list-style-type: none"> <li>• If digital cameras are built in, they usually do not produce good quality pictures</li> <li>• It might be a tedious process to transfer pictures from an external digital camera to the Tablet PC</li> </ul>
<b>Sketching the forensic scene</b>	<ul style="list-style-type: none"> <li>• Sketching is not as natural as using a pencil and paper</li> </ul>
<b>Record vocal interviews with people that were present at the forensic scene</b>	<ul style="list-style-type: none"> <li>• Sound quality can vary depending on the quality of sound being recorded. Better quality means using up more disk space.</li> </ul>
<b>General</b>	<ul style="list-style-type: none"> <li>• Can be expensive (between \$900 – \$1500 U.S. Dollars)</li> <li>• They are pretty big, almost like a laptop</li> </ul>

The advantages and disadvantages demonstrated that Tablet PCs are very good candidates for documenting a forensic scene. Another mobile device choice would be a PDA.

### 9.2. Personal Digital Assistants (PDAs)

“PDA (Personal Digital Assistant) is a term for any small mobile hand-held device that provides computing and information storage and retrieval capabilities for personal or business use, often for keeping schedule calendars and address book information handy. The term handheld is a synonym. Many people use the name of one of the popular PDA products as a generic term. These include Hewlett-Packard's Palmtop and 3Com's Palm Pilot. Most PDAs have a small keyboard. Some PDAs have an electronically sensitive pad on which handwriting can be received. Apple's Newton, which has been withdrawn from the market, was the first widely-sold PDA that accepted handwriting. Typical uses include schedule and address book storage and retrieval and note-entering. However, many applications have been written for PDAs. Increasingly, PDAs are combined with telephones and paging systems” [7].

There are numerous advantages for using a PDA as a platform to develop software that can be used to document a forensic scene. There are also some disadvantages. The advantages and disadvantages are portrayed in Tables XIII and XIV. The advantages and disadvantages are explained in reference to the “Major Framework for Documenting a Forensic Scene” illustrated in Table II.

TABLE XIII  
Advantages of Using a PDA

Category	Advantages
<b>Note taking at the forensic scene</b>	<ul style="list-style-type: none"> <li>• A screen, with a stylus (pen for writing)</li> <li>• Built in hand recognition software, so that all notes can be converted to typed textual format on the fly</li> <li>• Some Tablet PDAs offer keyboard input, which can be used for note taking</li> </ul>
<b>Video taping the forensic scene</b>	<ul style="list-style-type: none"> <li>• If digital video taping is used on an external camera, it could be transferred to the PDA using traditional computer transfer methods</li> <li>• PDAs have cameras with Software Development Kits (SDKs). They can be easily plugged into the device and used in the mobile software developed for documenting a forensic scene.</li> </ul>
<b>Photographing the forensic scene</b>	<ul style="list-style-type: none"> <li>• Built in digital cameras are available with some PDAs</li> <li>• If an external digital camera is used for better quality results, pictures can be transferred to the PDA using traditional computer transfer methods</li> <li>• Pictures can be logged with textual input</li> </ul>
<b>Sketching the forensic scene</b>	<ul style="list-style-type: none"> <li>• Sketching is made possible with the stylus and screen</li> <li>• A drag and drop sketching scheme can be used, meaning that preset images can be used (e.g. preset images for chairs, tables, rooms), to make sketching easier</li> <li>• GPS technology can be used in order to help map exact points and distances when sketching. There are available GPS systems with SDKs that can be used when writing software for documenting a forensic scene</li> </ul>
<b>Record vocal interviews with people that were present at the forensic scene</b>	<ul style="list-style-type: none"> <li>• PDAs usually have built in microphones which can aid in recording interviews</li> <li>• Almost all Tablet PCs have an input for microphones if they do not have built-in microphones</li> </ul>
<b>General</b>	<ul style="list-style-type: none"> <li>• PDAs are inexpensive (200 – 600 U.S. Dollars)</li> <li>• PDAs are very small</li> <li>• Easy to program for, almost like programming for a Windows OS, if Microsoft's Pocket PC was used as an OS</li> </ul>

TABLE XIV  
Disadvantages of Using a PDA

Category	Disadvantages
<b>Note taking at the forensic scene</b>	<ul style="list-style-type: none"> <li>• It is not as natural to write on a PDA as it is on paper</li> <li>• Hand recognition might not work well for everyone</li> <li>• It takes training and extensive use to get accustomed to using the stylus for input</li> <li>• PDA input screen is small, not as big as a paper</li> </ul>
<b>Video taping the forensic scene</b>	<ul style="list-style-type: none"> <li>• PDAs usually do not have digital cameras built into them</li> <li>• The cameras for PDAs do not produce videos that are of great quality</li> <li>• PDAs usually have a small amount of disk space so large video captures can be a problem. This is slowly changing as PDA technology is improving</li> </ul>
<b>Photographing the forensic scene</b>	<ul style="list-style-type: none"> <li>• If digital cameras are built in, they usually do not produce good quality pictures</li> <li>• It might be a tedious process to transfer pictures from an external digital camera to the PDA</li> <li>• PDAs usually have a small amount of disk space so numerous photographic captures can be a problem. This is slowly changing as PDA technology is improving</li> </ul>
<b>Sketching the forensic scene</b>	<ul style="list-style-type: none"> <li>• Sketching is not as natural as using a pencil and paper</li> <li>• The screen for a PDA is really small, so sketching a large scene can be an issue</li> </ul>
<b>Record vocal interviews with people that were present at the forensic scene</b>	<ul style="list-style-type: none"> <li>• Sound quality can vary depending on the quality of sound being recorded. Better quality means using up more disk space</li> </ul>
<b>General</b>	<ul style="list-style-type: none"> <li>• They are small devices – easily lost</li> <li>• If the device is not charged, data can be lost</li> </ul>

The advantages and disadvantages showed that PDAs can be very good candidates for documenting a forensic scene as well. The researcher has had experience in the past programming for mobile devices, such as PDAs and Tablet PCs. For software to be written, a simplified software framework has to be formulated and used.

## 10. PROPOSED MOBILE SOFTWARE FRAMEWORK FOR FORENSIC SCENE DOCUMENTATION

After reading and analyzing different literature on forensic scene documentation, the “*Major Framework for Documenting a Forensic Scene*” illustrated in Table II seemed to apply to all forensic disciplines. However, as illustrated in some of the sections that discussed note taking, photography and other items that are part of the “Major Framework”, the researcher realized that beyond the five major items in the “Major Framework”, some forensic disciplines have different and unique ways of documenting data. For example, a forensic engineer might use certain apparatus like an infra-red thermometer to take burn temperature readings, and a crime scene investigator might not. Furthermore, if a preset list of items were to be used when developing a software that aids forensic engineers to sketch a forensic scene using a Tablet PC, or a PDA, like a dead body, chair and a car, the process of sketching a forensic scene becomes easier.

It makes sense that the proposed software framework takes into account the “Major Framework” exemplified in Table II and the various needs that forensic disciplines have when documenting a forensic scene. The proposed framework is illustrated in Figure 1.

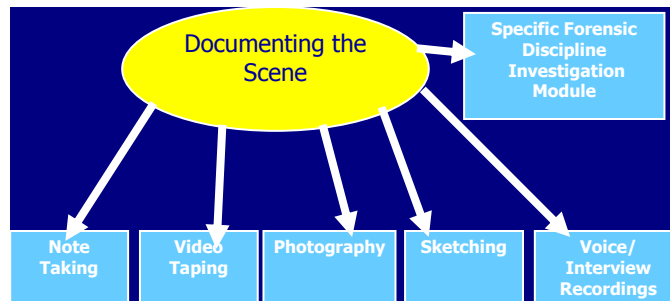


Figure 1

Figure of Proposed Framework

As illustrated in Figure 1, the framework includes all five items that were discussed in Table II. However, documenting the scene is not limited to those five items, and each forensic discipline needs to be studied in detail so that the standards for that specific forensic discipline can be identified and integrated into the mobile software.

## 11. COMPUTER FORENSIC SCENE DOCUMENTATION

Computer Forensics also known as (Digital or Cyber Forensics) is a new field. Special attention is being given to this field due to its lack of a sound and scientific knowledge base. The proposed framework for forensic scene documentation also applies to this new field.

Thomas Rude explained that there are four main steps for evidence seizure 1) Preparation, 2) Snapshot 3) Transport 4) Preparation [8]. During the snapshot step he explained that the following should be done

- Photographing the scene

- Noting the scene
- Photographing evidence
- Documenting the PC
- Labeling evidence
- Photographing the evidence after the labels are applied
- Videotaping the entry of personnel

As one can see this correlates and coincides with the ideas of scene documentation proposed in other forensic disciplines. In a guide proposed by the National Institute of Justice, called “Electronic Crime Scene Investigation: A guide for first responders” [9], similar views were also stated. The views represented are presented in Table XV.

Table XV  
Views Presented By NIJ Guide [9]

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NIJ Digital Crime Scene Documentation Suggestions as mentioned in the guide [9]
Procedure: The scene should be documented in detail
Initial documentation of the physical scene:
<ul style="list-style-type: none"><li>• Observe and document the physical scene, such as the position of the mouse and the location of components relative to each other (e.g., a mouse on the left side of the computer may indicate a left-handed user)</li><li>• Document the condition and location of the computer system, including power status of the computer (on, off, or in sleep mode). Most computers have status lights that indicate the computer is on. Likewise, if fan noise is heard, the system is probably on. Furthermore, if the computer system is warm, that may also indicate that it is on or was recently turned off</li><li>• Identify and document related electronic components that will not be collected</li><li>• Photograph the entire scene to create a visual record as noted by the first responder. The complete room should be recorded with 360 degrees of coverage, when possible</li><li>• Photograph the front of the computer as well as the monitor screen and other components. Also take written notes on what appears on the monitor screen. Active programs may require videotaping or more extensive documentation of monitor screen activity</li><li>• Note: Movement of a computer system while the system is running may cause changes to system data. Therefore, the system should not be moved until it has been safely powered down as described in chapter</li><li>• Additional documentation of the system will be performed during the collection phase</li></ul>

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In the NIJ guide, during the evidence collection phase, other attributes of computer scene documentation were described based on certain situations, like the use of a laptop computer, desktop computer, monitor is on, and monitor is off. These are situations that should be documented as they can change the evidence while it is being documented. These specific requirements can be integrated into the “Specific Forensic Discipline Investigative Module”. This is where this module comes in handy when programming a mobile system.

A good example to discuss is sketching a room with computers V.S. sketching a car accident. In both cases, sketching the scene is crucial, however in one situation the investigator will be sketching a car, and in the other, the investigator will be sketching a computer. If mobile software were to be used by an investigator, say, a digital forensics investigator, it would be appropriate to include a standard

sketch of a computer system that could be easily “dragged and dropped” onto a digital “sketch pad”, whereas a car accident specialist/investigator would probably prefer to have a car as a preset image for sketching rather than a computer system.

There are items that are specific to the field of digital forensics scene documentation when compared to other disciplines. These specific items should be implemented in the “Specific Forensic Discipline Investigative Module” if software is designed to aid in the documentation process. These items are presented in Table XVI

Table XVI  
Specific Items for Digital/Computer/Cyber Forensics[10][12]

Category	Explanation
<b>Computer Date/Time Settings</b>	<ul style="list-style-type: none"> <li>• Document date and time of when files were created</li> <li>• Documenting the accuracy of the settings of the CMOS</li> <li>• Current time can be obtained from the telephone company or internet</li> <li>• Perform bit-stream backup of the system first</li> </ul>
<b>Hard Disk Partitions</b>	<ul style="list-style-type: none"> <li>• Document: make, model and size of all hard disk drives by physically examining the drive</li> <li>• Document the partitions of the hard drives</li> <li>• Document hidden partitions and data</li> </ul>
<b>Operating System and Version</b>	<ul style="list-style-type: none"> <li>• A computer may have more than one OS, and they should all be documented</li> <li>• This can be done by examining the boot sector of the partitions (in DOS and Windows). This can also be done using utilities</li> <li>• The version should also be documented</li> <li>• The version of the software used to document this information should also be documented</li> </ul>
<b>Data and Operating System Integrity</b>	<ul style="list-style-type: none"> <li>• Document the results of running programs to check for disk errors and document the errors</li> <li>• Errors should be fixed/repared at the discretion of the forensic professional, and all fixed errors should be documented</li> </ul>
<b>Virus Evaluation</b>	<ul style="list-style-type: none"> <li>• Devices should be scanned by NIST certified scanning utilities (McAfee, Norton, Solomon)</li> <li>• It is a good practice to use more than one virus scanning software</li> </ul>
<b>File Catalog</b>	<ul style="list-style-type: none"> <li>• The files should be cataloged and listed</li> <li>• Dates and times of creation and updating should be documented</li> <li>• Sorting of files by date/time is good</li> </ul>
<b>Software Licensing</b>	<ul style="list-style-type: none"> <li>• The license of the software being used by the investigator should be documented</li> </ul>
<b>Retention of Software, Input files and Output files</b>	<ul style="list-style-type: none"> <li>• Files should be retained in case an investigator wants to analyze the data later on if something new comes up in the investigation</li> </ul>

## 12. CONCLUSIONS

Documenting a forensic scene is not a standardized process. The process for documenting a forensic scene has been assembled by different forensic experts in the field and can vary from one discipline of forensics to another. A “Major Framework” was identified in Table II, for documenting a forensic scene that includes note taking, video taping, photography, sketching and voice/interview recordings.

All these items can be used in an application that can be programmed for a PDA or a Tablet PC. Both Tablet PCs and PDAs have advantages and disadvantages if used as devices to aid in documenting a forensic scene. If software were to be developed for either, a specific forensic discipline investigation module would have to be added to supplement the forensic discipline under investigation. Although Digital Forensics is a new discipline, it fits the model discussed in the paper. Integrating mobility with forensic scene documentation is an innovative idea that might aid in standardizing forensic scene documentation and ameliorating the discipline of forensics.

### 13. FUTURE RECOMMENDATIONS

The researcher recommends further exploring the different disciplines of forensic engineering and crime scene investigation to identify the various modules that are needed to complete the proposed framework. Furthermore, when that framework is complete, the researcher recommends performing a study by writing a mobile software system for documenting a forensic scene. Additionally, that system should be tested using both PDAs and Tablet PCs to see which mobile device might be of greater benefit to forensic professionals. To complete the study, the system should be used in a real life environment such as a police department, or it could be tested by different forensic engineers in various disciplines.

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