**Review of the Literature**

Introduction

Our military and other government components such as the Department of Defense develop technology to keep United States citizens safe by improving on existing methods that identify and stop combatants. One method used to identify a suspect is by recovery DNA. When an improvised explosive device (IED) is detonated bomb fragments are recovered and examined in order to attempt to determine the identity of the bomb maker. Iris, facial, and vascular recognition are other biometrics tools used to identify our adversaries. Linking forensic functions with biometric capabilities is a relatively new form of technology and is discussed in the literature presented.

Techniques

According to a study by Chirchi, Waghmare, and Chirchi (2011), choosing the proper biometric tool to fit the specific situation requires knowledge of technological developments. One such development is the iris scan. Found to be a reliable form of authentication the military has evolved this form of biometric identification into a portable tool on the battlefield. The biometric automated toolset (BAT) is the primary system used by the U.S Central Command to store biometric data such as iris scans, (D’Agostino, 2008). The iris scan is a unique form of identification. In its genetic properties no two eyes are the same and furthermore the characteristic that is dependent on genetics is the pigmentation of the iris, (Chirchi, Waghmare, and Chirchi, 2011).

Although not less reliable but a less developed form of biometric identification is facial recognition. It utilizes automated methods to verify the identity of a person based on physiological characteristics. Tolba, El-Baz, and El-Harby (2011) describe facial recognition as a way to detect facial patterns even in a crowded scene using classification algorithms. A computer algorithm “normalizes” the biometric signature so that it is in the same format as the signatures on the system’s database (Tolba, 2011). Facial recognition is seen as a convenient biometric tool due to being both machine-readable and human readable. The ubiquity of surveillance cameras means that, in a sense, a face can leave a trace and therefore be useful forensically, as are DNA and fingerprints, (DOD, 2007).

Methods

A significant tool in biometric identification is the use of DNA analysis, particular with recovering fingerprints. Esslinger, Siegel, Spillane, and Stallworth, (2004) research involved using short tandem repeat (SRT) analysis to detect human DNA from exploded pipe bomb devices. The effect on the DNA left on the components correlated with the material the pipe was made of (pvc vs. steel), the fragmentation pattern, and low vs. high explosives. One issue I noticed and it was briefly mentioned in the article, was with the reliability of the material the pipes were made. Steel is known to conduct heat better than PVC. The theory was since steel generates more heat during an explosion the chance for degradation of the DNA would increase. However since steel is more durable than PVC the percentage of larger fragments should increase. The more fragments, the more DNA could be collected. The data from the experiment showed the steel and PVC pipes had a similar success rate for DNA recover.

Foran, Gehring, and Stallworth (2009) research included the recovery and analysis of mitochondrial DNA (mtDNA) from exploded pipe bombs. The importance and difference from STR analysis is that mtDNA analysis allows DNA that has been extracted from hair, fingernails, and bone to be examined when nuclear DNA cannot be recovered. Another significant difference is mtDNA sampling can be obtained from not only the subject but also related family members. The article discussed the materials and methods used in the test as well as the resulting bomb fragmentation and the correlation with the quality and quantity of DNA recovered. The results of the study showed the value of mtDNA analysis in identifying the manufactures of various detonated IEDs.

Recovering fingerprints and other forms of DNA from various surface areas is not always textbook. Elements such as temperature, humidity, moisture, and material of surface area all affect the quality and ability to recover DNA. Shalhoub et al, (2008) researched a fast curing silicone-casting material (Isomark) as an effective method to obtain a reliable DNA profile from the casts of the fingerprints. Participants were asked to handle six different surfaces of various textures. This study was significant because various items are often used in IEDs that serve as projectiles. The Army field manual FM 3-34.119 (2005) describes various casings used such as pipes, soda cans, metal containers, all which turn into projectiles when detonated. Once recovered contents inside such as marbles, nails, rocks, and glass can all be examined for DNA. Through their research Shalhoub et al, (2008) concluded it was possible to recover DNA from Isomark casts made on all substrates tested. However, no link was noted between quality of finger marks obtained and the amount of DNA extracted from them, Shalhoub (2008).

Summary

Although the research discovered additional technology questions the research summaries concluded favorable results for recovering DNA from bomb components leading to identifying the bomb maker. Biometrics tools such as iris scanning, facial recognition, and fingerprinting are valuable components to identifying our adversaries and using that intelligence to mitigate against future attacks.

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