Automatic Injury Detection (AID)

System Design for

Montgomery County, VA

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1. Introduction

The Automatic Injury Detection (AID) system provides help in seconds when the sensor panel has been pierced by a bullet, knife or shrapnel. The AID system sends an automated emergency alert to a phone, radio or via other communication system. The automated and instant emergency alert helps save lives. Once hit, an officer or warfighter often needs to fight, flee or becomes incapacitated such that they are unable to get help immediately. AID improves the ability and speed at which they can get medical attention and/or backup help in the fight against the attacker.

Montgomery County, Virginia is located in the western part of the state and has a population of nearly 100,000. The cities of Christiansburg and Blacksburg, and Virginia Tech University are located within the county. Following a live fire demonstration, Sheriff Hank Partin obtained funds from the Montgomery County Board of Supervisors to purchase AID systems and new Kenwood radios for the 120 members of the sheriff's department.

Montgomery County Radio Decision

The Montgomery County Sheriff's (MCS) department was using Kenwood NX-300 radios for voice communications. The NX-300 doesn't provide the Bluetooth capability needed to connect with the AID system. Also, the radios don't have an integrated GPS receiver for location. We considered developing an option board for the radio for the Bluetooth function but MCS decided they needed to upgrade their radio for future P25 needs and for improved AID compatibility. They chose the Kenwood NX-5300 with Bluetooth (version 3) and GPS location functions.

2. AID Sensors

AID sensors can be designed to fit virtually any size and shape. To obtain the best fit for MCS, we measured their protective vests – most of them were the Point Blank/PACA brand. From those measurements, we developed templates for 11 sizes, 10 of which are bell-shaped (see Figure 1: Measuring Protective Vest and Comparing Template Size) and one size that fits the SWAT team protective plates.

Figure 1: Measuring Protective Vest and Comparing Template Size

The sensors are placed in the front and back of the protective vest, in front of the ballistic material. It is critical that the sensor panel fit the width and height to properly protect the torso. The fit is less critical on the sides.

3. AID Communication Module

The driving requirement for connectivity and communication is that the AID system must send an emergency alert to the Kenwood NX-5300 radio and the users phone. Most officers carry a personal phone and AID is compatible with Android-based phones. Since the radio only supports Bluetooth classic and we use Bluetooth Low Energy (version 4) to connect with the phone, we designed the module to support both versions of Bluetooth.

The AID communication module is powered by a rechargeable Lithium Polymer battery that can last for over two years. The module has a rugged micro-B USB port for charging and provisioning (see Figure 2: AID Communication Module Attached to Sensor Panel).

Figure 2: AID Communication Module Attached to Sensor Panel

Android Phone Pairing

The AID module pairs with an Android phone using the AID app (found in the Google Play Store). The Bluetooth Low Energy (BLE) portion of the module broadcasts as a device available to pair. The pairing process is managed through the AID app on the phone.

Kenwood Radio Pairing

The Kenwood NX-5300 radio operates as a Bluetooth device (i.e. not the host) so the AID module must perform the pairing. That is accomplished using the AID Config PC application.

4. AID Software Applications

The AID system includes two software applications, an Android-based AID app and the AID Config PC application. The AID app is required for wirelessly connecting, set-up, and operation with a smartphone. The AID Config application runs on a Windows PC and connects via USB to the AID module. AID Config provides the pairing function with the radio. It's also possible to test the AID system using AID Config – when selected, the AID system will automatically send the emergency alerts to the radio and phone as if the sensor has been pierced.

5. AID Operation

Once paired with a phone and radio, there is little to no interaction required with the AID system – only the occasional check on battery life and, if desired, an infrequent test of the system.

When a sensor panel has been pierced, the AID system will automatically perform the following functions:

Via Phone
- Sends an SMS message to the recipient(s) (see Figure 3: SMS Message Received by Recipient) based on the list of SMS numbers the user had entered during set-up (The Sheriff wants him and captains to be notified). The message includes:
    o Notification of the injury and zone (upper/lower front/back)
    o The officer's name and any other personal information (e.g. blood type, allergies) entered during set-up
    o Link to the officer's location based on the phone's GPS location (see Figure 4: SMS Link Displays Location on Google Maps).
- Initiates an optional phone call to a recipient based on the phone number that was entered during the set-up.
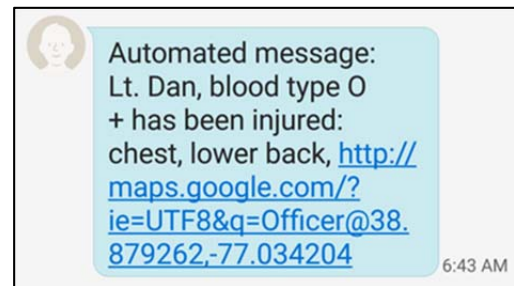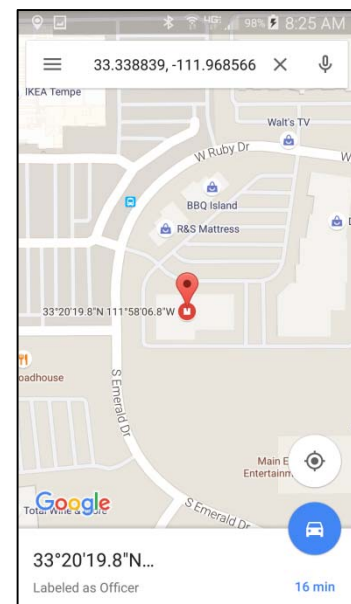

Figure 3: SMS Message Received by Recipient

Via Radio
- Activates a custom radio button that sends an 'MCSO SHOT DETECT' alert message to every radio in the network including the dispatch center
- Sends the GPS location based on the radio's GPS location to the radio network

AID have the ability to send additional information through the radio such as the injury zone and officer's personal information but Montgomery County has a single, analog channel that is used for all voice and data. We've limited the amount of data sent in order to keep the channel clear for follow-on communications.

To send the alert and GPS location, the radio side-button (button #3) was programmed to do that function manually (by holding the button down for 3 seconds - to avoid accidental button presses). The AID command virtually activates the button immediately upon incident.

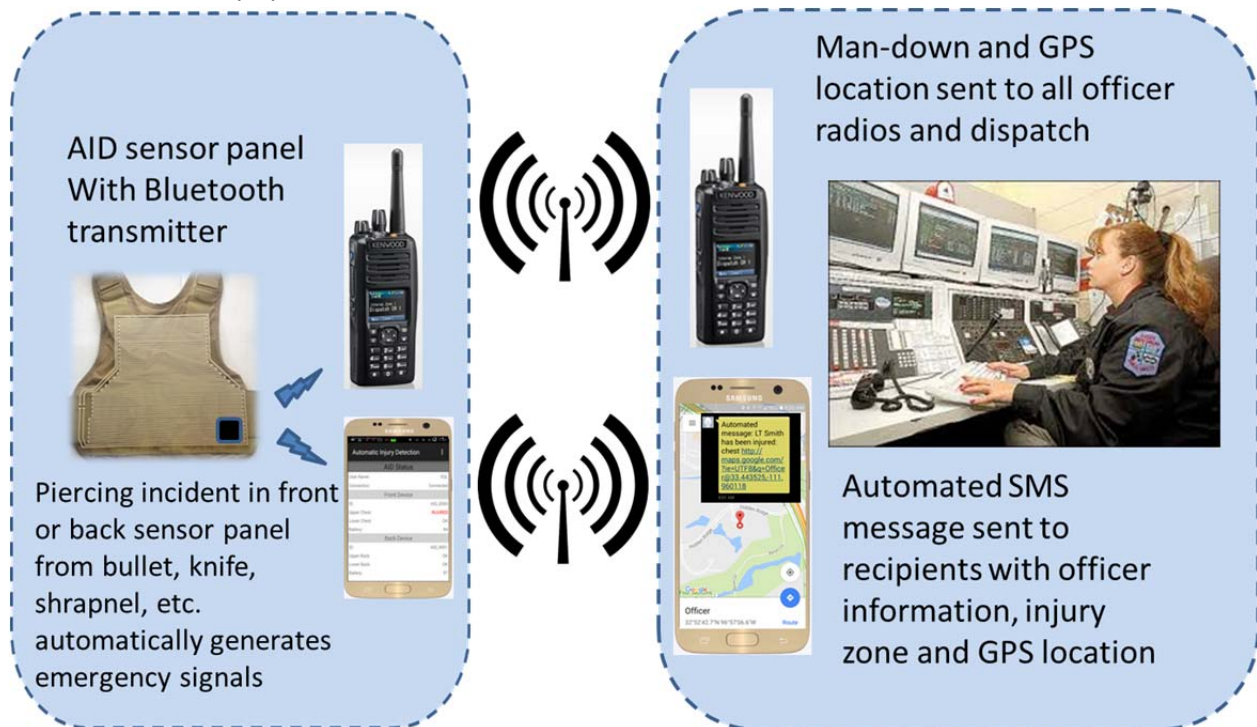**Figure 4: SMS Link Displays Location on Google Maps**

Figure 5: AID System Design for Montgomery County, VA

6. Montgomery County Dispatch

Montgomery County uses DataLink Systems Inc. software to parse out the message information from the base unit radio. The information is presented to dispatch on a dedicated display using maps from the county-based Geographic Information System (GIS).