TechNote

U.S. Department of Homeland Security

SAVER

System Assessment and Validation for Emergency Responders

The Federal Emergency Management Agency (FEMA) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. The SAVER Program conducts objective operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the Department of Homeland Security's Authorized Equipment List (AEL).

Information provided by the SAVER Program will be shared nationally with the responder community providing life- and cost-saving assets to FEMA, as well as federal, state, and local responders.

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, please see the SAVER website or contact the SAVER Program Support Office.

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SPAWAR

Systems Center ATLANTIC

Wireless Surveillance Camera Systems

Wireless surveillance camera systems are often used in law enforcement applications to provide monitoring and surveillance video. Additionally, the systems can be used in emergency situations to capture video of rescue and recovery efforts. The systems capture live video and transmit it over designated radio frequency (RF) bands for viewing and/or recording. The cameras can be mounted in locations where cabled surveillance camera systems are not possible, giving designers and operators more freedom and flexibility when implementing systems.

Technology Overview

Wireless surveillance camera systems include a camera, transmitter, receiver, monitor, and possibly a data storage device. Video captured by the camera is broadcast using a radio transmitter and antenna. The transmitter and antenna may be built into the camera or separate devices attached to the camera with a cabled connection. Most often, the video is digitized prior to transmission. Analog cameras can use an integrated or external digital encoder to digitize the video. Digital cameras, including Internet Protocol cameras (also known as network or IP cameras), have an integrated encoder. Once digitized, the video is streamed over the wireless transmission system.

The video data streams are transmitted using RF to a receiver, where they are processed and displayed. Digitally encoded video can be streamed to a variety of devices, including PCs, personal digital assistants (PDAs), or cellular phones. The video can also be recorded using a digital video recorder (DVR) or network video recorder (NVR).

Figure 1. Wireless Surveillance Camera with Built-in Transmitter and Antenna

The range of a wireless system is the maximum distance the receiver can receive a usable signal from the transmitter. This range is usually given in feet or meters and depends a great deal on the both the operational frequency of the system and the medium through which the signals are transmitted. The most ideal situation is called a clear line of sight (LOS), where there are no obstructions between the transmitter and the receiver. Under these conditions, the system will have the largest range. Objects such as buildings, trees and vehicles, however, will reduce the effective range. For instance, a wireless camera with a reported range of 700 feet LOS may have a reduced range of 300 feet if the signal has to travel through a building. In extreme cases, the

wireless signal may be weakened to the point that the effective range is so low that the equipment is not useable for the intended application.

Radio Frequencies

Wireless surveillance camera systems primarily operate in the 700 MHz, 900 MHz, 2.4 GHz, 4.9 GHz, and 5 GHz RF bands. These RF bands offer varying bandwidth, range, and penetration capabilities. Although these RF bands have sufficient bandwidth to transmit a video signal, interference from other wireless devices operating in the same frequencies, such as cordless phones, can reduce the available bandwidth and ability to transmit a video signal. Many systems are capable of changing frequencies and channels to compensate for wireless interference. Additionally, systems in the 4.9 GHz and 5 GHz bands are less susceptible to interference, as there are fewer devices that operate in these bands. However, systems in the 4.9 GHz and 5 GHz bands are less capable of penetrating obstacles such as trees and buildings. The 700 MHz and the 4.9 GHz bands are also less susceptible to interference as they are designated for use by public safety organizations by the Federal Communications Commission (FCC).

Security of Wireless Video

Standards for wireless networks are set by the Institute of Electrical and Electronic Engineers (IEEE). Wireless systems operating in the 2.4 GHz, 4.9 GHz, and 5 GHz frequency bands must comply with the IEEE 802.11 standard. IEEE 802.11 encompasses a variety of wireless protocols including security, bandwidth, and Quality of Service (QoS).

To mitigate electronic trespassing and to ensure secure wireless data transmission, a digital video signal can be encrypted. The original IEEE 802.11 security techniques known as Wired Equivalent Privacy (WEP) encryption and Wi-Fi® Protection Access™ (WPA) were found to be very easily broken. The newer WPA2™ standard uses the Advanced Encryption Standard (AES), a more secure encryption algorithm. The AES helps to ensure that only authorized devices are able to decode the transmitted radio signal. The WPA2 standard also includes provisions for authentication of wireless systems and devices. Given the possible security vulnerabilities in WEP and WPA, the National Institute of Standards and Technology (NIST) recommends that only WPA2 certified systems should be used by government agencies.

Applications and Configurations

The cameras that can be used in a wireless surveillance camera system come in different shapes and sizes and are designed for various applications. Some cameras are made for mounting in fixed locations, such as offices, police stations, prison common areas, parking lots, ports, and forest towers. Some cameras are manufactured specifically for outdoor use and are enclosed in protective housings that enable video to be captured in adverse weather conditions. Outdoor cameras use thermal, infrared, or day/night technologies to enhance the quality of the video in low-light situations.

Many cameras in a wireless surveillance camera system are covert and may be disguised as everyday devices, such as clocks, security lights, and smoke detectors. As these cameras are easy to hide from view, they are often used in law enforcement applications to gather video evidence during investigations. Some of these cameras are as small as a dime and can be fashioned into a button and worn on a police officer's uniform. When considering the use of covert cameras, state regulations should be consulted as some states prohibit the use of certain types of covert cameras.

Some wireless surveillance camera systems are designed to be mobile. These mobile systems typically include a wireless camera (mounted to a tripod or telescoping pole), a monitoring station, and a protective carrying case. Mobile wireless surveillance camera systems can be transported to disaster or crime scenes and deployed quickly— some in as little as 15 minutes. The cameras in mobile systems are battery operated and many feature internal hard drives or removable storage media to record video in the event transmission of the radio signal fails.

Additional Resources

IEEE 802.11 Standard
http://standards.ieee.org/wireless/overview.html

Responder Knowledge Base
https://www.rkb.us

802.11 Technology SAVER TechNote
https://saver.fema.gov