Concealed Weapon Detection Using Image Processing

Bhavna Khajone, Prof. V. K. Shandilya

Abstract— We have recently witnessed the series of bomb blasts in Mumbai which killed and left many injured, left the world in shell shock and the Indians in terror.

This situation is not limited to India but it can happen anywhere and anytime in the world. Here we show you the technology which predicts the suicide bombers and explosion of weapons through, **IMAGING FOR CONCEALED WEAPON DETECTION**.

Manual screening procedures for detecting concealed weapons such as handguns, knives, and explosives are common in controlled access settings like airports, entrances to sensitive buildings, and public events. The detection of weapons concealed underneath a person's clothing is an important obstacle to the improvement of the security of the general public as well as the safety of public assets like airports and buildings. It is desirable to be able to detect concealed weapons from a standoff distance, especially when it is impossible to arrange the flow of people through a controlled procedure. The goal is the eventual deployment of automatic detection and recognition of concealed weapons. It is a technological challenge that requires innovative solutions in sensor technologies and image processing. A number of sensors based on different phenomenology as well as image processing support are being developed to observe objects underneath people's clothing.

In **'CONCEALEAD WEAPON DETECTION'** the sensor improvements, how the imaging place techniques for simultaneous noise suppression, object enhancement of video data and describes mathematical results[1].

Index Terms— Weapon Detection By Image Processing, Weapon Diagnosis,Image Sensing,Image Registration,Image Processing.

1 INTRODUCTION

WHAT IS IMAGE PROCESSING?

The term digital image processing refers to scientific and technical pursuits. Processing of an image includes improvement in its appearance and efficient representation. Image processing is widely being used today. Interest in digital image processing stems from two principle applications areas: improvement of pictorial information for human interpretation, and processing of scenes data for autonomous machine perception[1].

2. HOW IT IS DONE?

This involves converting the visual information into discrete form suitable for computer processing. Computer processes discrete information of an image using various mathematical tools MORPHOLOGY is one of them, which offers a broad set of image processing operations that process images based on shapes. Morphological operations apply a structuring element to an input image, creating an output image of the same size[2].

Manual screenings procedures screens the person when the person is near the screening machine and also sometimes it gives wrong alarm indications so we are need of a technology that almost detects the weapon by scanning which achieved by imaging for concealed weapons[3].

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IMAGING SENSORS

These imaging sensors developed for CWD applications depending on their portability, proximity and whether they use active or passive illuminations. The different types of imaging sensors for CWD based areas be

1. INFRARED IMAGERS:

Infrared imagers utilize the temperature distribution information of the target to form an image. Normally they are used for a variety of night-vision applications, such as viewing vehicles and people. The underlying theory is that the infrared radiation emitted by the human body is absorbed by clothing and then re-emitted by it. As a result, infrared radiation can be used to show the image of a concealed weapon only when the clothing is tight, thin, and stationary. For normally loose clothing, the emitted infrared radiation will be spread over a larger clothing area, thus decreasing the ability to image a weapon[1].

2. P M W IMAGING SENSORS:

FIRST GENERATION:

Passive millimeter wave (PMW) sensors measure the apparent temperature through the energy that is emitted or reflected by sources. The output of the sensors is a function of the emissive of the objects in the MMW spectrum as measured by the receiver. Clothing penetration for concealed weapon detection is made possible by MMW sensors due to the low emissive and high reflectivity of objects like metallic guns[3].

Following figure1 (a) shows a visual image of a person wearing a heavy sweater that conceals two guns made with metal and ceramics. The corresponding 94-GHz radiome-

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tric image figure1 (b) was obtained by scanning a single detector across the object plane using a mechanical scanner. The radiometric image clearly shows both firearms.

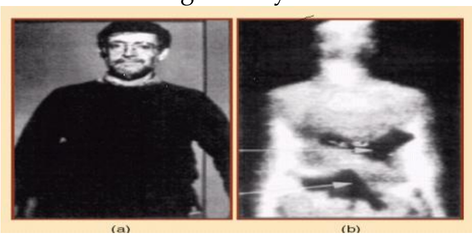


Fig:1(a)visible (b) MMW image of a person concealing 2 guns beneath a heavy sweater

SECOND GENERATION:

Recent advances in MMW sensor technology have led to video-rate (30 frames/s) MMW cameras. One such camera is the pupil-plane array from Terex Enterprises. It is a 94-GHz radiometric pupil-plane imaging system that employs frequency scanning to achieve vertical resolution and uses an array of 32 individual wave-guide antennas for horizontal resolution. This system collects up to 30frames/s of MMW data. Following figure shows the visible and second-generation MMW images of an individual hiding a gun underneath his jacket[1].

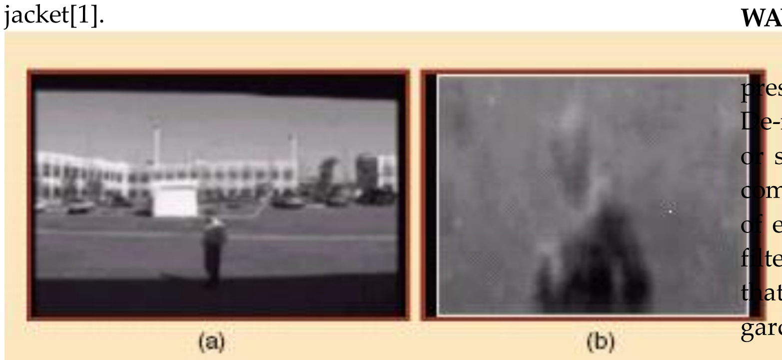
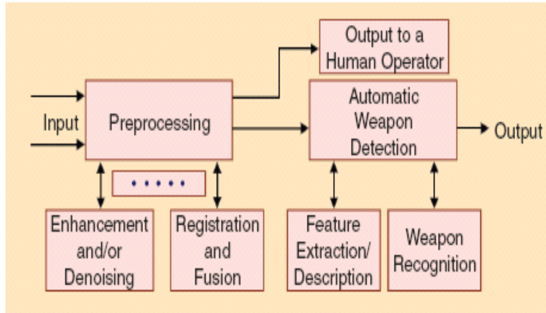


FIGURE:2a) visual image 2b) second-generation image of a person concealing a handgun beneath a jacket.

CWD THROUGH IMAGE FUSION:

By fusing passive MMW image data and its corresponding infrared (IR) or electro-optical (EO) image, more complete information can be obtained; the information can then be utilized to facilitate concealed weapon detection. Fusion of an IR image revealing a concealed weapon and its corresponding MMW image has been shown to facilitate extraction of the concealed weapone.

IMAGING PROCESSING ARCHITECTURE:



An image processing architecture for CWD is shown in Figure 4.The input can be multi- sensor (i.e., MMW + IR, MMW + EO, or MMW + IR + EO) data or only the MMW data. The output can take several forms. It can be as simple as a processed image/video sequence displayed on a screen[1].

1) IMAGE DENOISING & ENHANCEMENT THROUGH WAVELETS:

We describe a technique for simultaneous noise suppression and object enhancement of passive MMW video data. De-noising of the video sequences can be achieved temporally or spatially. First temporal de-noising is achieved by motion compensated filtering, which estimates the motion trajectory of each pixel by various algorithms and then conducts a 1-D filtering along the trajectory. This reduces the blurring effect that occurs when temporal filtering is performed without regard to object motion between frames[1].

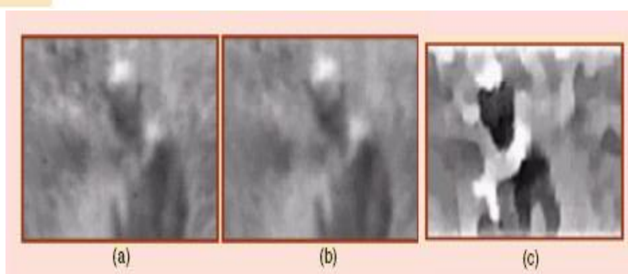


FIGURE3a): original frame 3b) de-noised frame 3c) de-noised and enhanced frame

2) REGISTRATION OF MULTI SENSOR IMAGES:

Use of multiple sensors may increase the efficacy of a CWD system. The first step toward image fusion is a precise alignment of images (i.e., image registration).In registration approach images taken at the same time from different but nearly collocated (adjacent parallel) sensors based on the max-

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imization of mutual information (MMI) criterion. MMI states that two images are registered when their mutual information (MI) reaches its maximum value.

For the registration of IR images and the corresponding MMW images of the first generation. At the first stage, two human silhouette extraction algorithms were developed, followed by a binary correlation to coarsely register the two images. This provides an initial search point close to the final solution for the second stage of the registration algorithm based on the MMI criterion. In this manner, any local optimizer can be employed to maximize the MI measure[4].

3) IMAGE DECOMPOSITION:

First, an image pyramid is constructed for each source image by applying the wavelet transform to the source images. This transform domain representation emphasizes important details of the source images at different scales, which is useful for choosing the best fusion rules. Then, using a feature Selection rule, a fused pyramid is formed for the composite image from the pyramid coefficients of the source images. The simplest feature selection rule is choosing the maximum of the two corresponding transform values. This allows the integration of details into one image from two or more images. Finally, the composite image is obtained by taking an inverse pyramid transform of the composite wavelet representation. The process can be applied to fusion of multiple source imagery.

This type of method has been used to fuse IR and MMW images for CWD application. The first fusion example for CWD application is given in Figure 4[1].

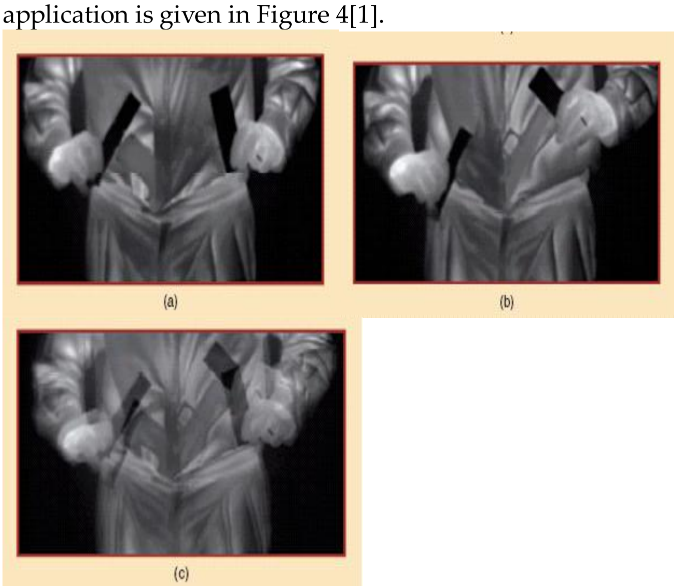

FIG 4: (a) and (b) are original I R images (c) is fused image

AUTOMATIC WEAPON DETECTION:

After preprocessing, the images/video sequences can be displayed for operator-assisted weapon detection or fed into a weapon detection module for automated weapon detection. Towcard this aim, several steps are required, including object extraction, shape description, and weapon recognition.

SEGMENTATION FOR OBJECT EXTRACTION

Object extraction is an important step towards automatic recognition of a weapon, regardless of whether or not the image fusion step is involved. It has been successfully used to extract the gun shape from the fused IR and MMW images. This could not be achieved using the original images alone. One segmented result from the fused IR and MMW image is shown in Figure 6. Another segmentation procedure applied successfully to MMW video sequences for CWD application is called the Slamani mapping Procedure (SMP).

4 Conclusion

Weapon Detection using Image Processing, involves manual screening procedures for detecting concealed weapons such as handguns, knives, and explosives are common in controlled access settings like airports, entrances to sensitive buildings, and public events.

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1) www.google.com
2) www.generation5.org
3) www.wikipedia.org
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