Security Systems for Remote Farm

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***Abstract* –This paper presents a security system for a remote farm. This research is ideal for locations where real time monitoring and notifications are paramount to your security wherein the image(s) detected through a surveillance system is processed by the newly advanced technology such as Open-source Computer Vision programming, Matlab programming and Artificial Intelligence Network. The research is all about detection process through Open- Source Computer Vision programming wherein multiple object detection can be applied. Future recommendations for image processing and recognition can be used through Matlab programming technology and Artifical Intelligence Network Technology.**

***Index Terms*—surveillance system, open-source computer vision programming, matlab programming, artificial intelligence network**

I. Introduction

Security is one of a becoming a notable issue for farmers [1]. One should consider the susceptibility to criminal acts such as theft of farm equipment, products or chemicals, destruction of confined animals, property, destruction of bioengineered plants, intentional introduction or release of a contagious animal or plant disease, and many more[1]. The jogger, the artifact collector, the mushroom hunter, the dog walker, the snowmobiler, and even your next-door neighbor were those that may represent a risk to your farm [1].

Many farmers have had crops, animals, or other property damaged for no apparent reason. It is important to identify, report, and secure valuable items that might tempt intruders [1]. The main objective of a detection system is to alert an individual when someone enters your property [1]. Some devices like electronic sensors and cameras can be very effective devices must be implemented to improve detection, delay, and response [1]. Electronic systems and devices appropriate for and suitable to farmsteads may include the following such as switches; motion sensors that will light an area when movement is detected; video recorders that are activated by motion. Alarms can be monitored at the farm or at allowed, any off-site alarm monitoring stations [1]. In addition to signalling a monitoring station and perhaps your computer, an activated alarm might trigger lights, make sounds, or place an automatic call to your cell phone.

For a more rapid and high detection rates of a visual object detection is to incorporate the system of an open-cv programming . This is a versatile factor for image processing . For the face recognition, matlab and artificial intelligence can be used [1]. Barriers such as fences, gates, locks are relatively inexpensive by comparison. Electronic systems like alarms, access controls, video surveillance, and motion sensors-can be somewhat expensive, but the security that it provides gives truly a beneficial one.

II. Review of Related Literature and Studies

Ambient Intelligence in Home Environments. The project is all about Computer Vision Tracking System [2].The message that comes from the warning was sent thru email or via alarm [2]. For the part of human tracking, he uses optical flow method and differential motion analysis [2]. For the fire detection, he uses flame recognition method through video and implementation of Open SourceComputer Vision (OpenCV) Library [3]. He uses servo motors controlled via ActiveX coming from the serial port [3]. The software consist of Graphical User Interface (GUI)[3]. Detection can be actuated in real time [3].

Detection Tracking and Recognition of Human Poses for a Real Time Spatial Game. For this paper, it introduces an approach to detect, track people and recognize poses [4]. Controlling a spatial time was used for detecting poses [4]. In the people detection, the torso and hands are segmented from the whole body and tracked over time [4]. They used classifiers for pose recognition [4]. The output of the classifier will be the identification of the pose [4].

Human Action Recognition Using Gaussian Mixture Model Based Background Segmentation. This paper was presented based on real-time system human action recognition [4]. It consists of based machine learning algorithm which helps to build intelligent surveillance systems [4].

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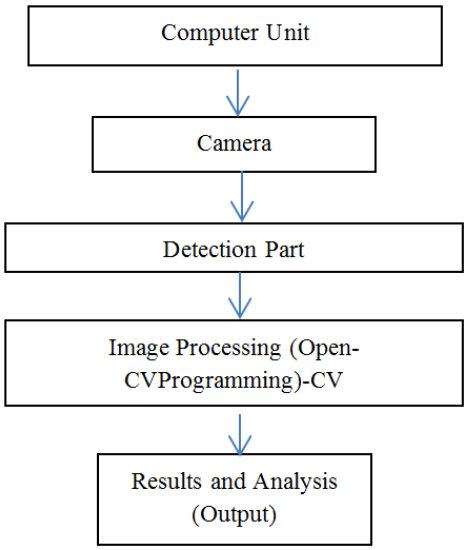
III. Methodology



A. Computer Unit

Any personal computer can be used in the system like desktop computer or notebook. The computer has at least 1.5 GHz processor, 300 MB RAM, 20 GB hard disk.

B. Camera

In this paper, it is suggested to use the thermal image camera. A thermal image camera allows to photographs when it is dark out. It is also an infrared camera that performs by exposing the charge coupled device (CCD) to the infrared light of the spectrum which cannot be seen to the naked eye.

C. Detection Part- Open Source Computer Vision (Open-CV) Programming using Background Subtraction

Open source computer vision library was based in C/C++ programming language. It was created and maintained by Intel [5]. It has a feature of cross-platform, portable, and good for real-time applications [6]. It is a library for real time image processing specifically for computer vision or machine vision [6]. OpenCV can be used for Human-Computer Interaction (HCI)[7], Object Identification[7], Segmentation, and Recognition[7] Face Recognition[7]; Gesture Recognition[8]; Motion Tracking, Ego Motion[8], and Motion Understanding[8]; Structure From Motion (SFM); and Mobile Robotics [8]. Computer vision is rapidly growing with the advent of video cameras, closed-circuit TV's (CCTV), high computing/processing power of computers, and open-source image processing softwares such as OpenCV [8].

The background subtraction will give the whole silhouette of the moving objects as well as the edges of the objects that move [9]. The background image uses current frames for the change in lighting conditions [9]. After obtaining the background image, the difference between the present frame and the background model is used to classify each pixel as either foreground or not [9]. A difference image, $D_{i,j}^t$ between an input image, $F_{i,j}^t$ and the background image, $B_{i,j}^t$ it shows only the regions that moves, while the stationary background is suppressed [9].

$$D_{i,j}^t = F_{i,j}^t - B_{i,j}^t \quad (1)$$

A foreground binary image can be obtained by using the difference image, $D_{i,j}^t$ and a threshold, T_d. [9].

IV. Data and Results

The code was compiled and run using OpenCV and Visual Studio. Median blurr threshold adjustments were added to the code in order to improve the detection by ignoring background noises from sudden change in lighting[10].

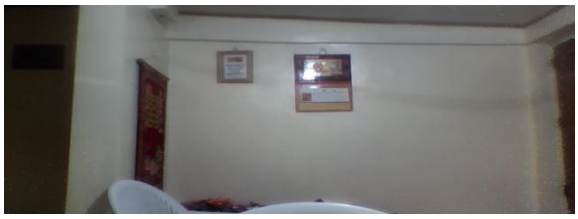


Figure 1. Background

Fig. 1 shows the background captured by the camera where next frames will be compared. When an object was introduced such as the arm in Fig. 3, the current frame will be compared to the background frame and resulting difference will be highlighted using contour tracing of the blob shown in Fig. 3.

Figure 2. Foreground

Figure 3. Blob

Fig. 3 is the resulting blob after background subtraction. This blob indicated a new object on the current frame compared to the background frame.

V. Analysis of Results

One known weakness of background subtraction comes from the fact that pixels are independently processed or computed [9]. Even minor changes in the pixels within the frames are being considered as motion. Lighting condition greatly affect the efficiency of this algorithm [10]. But "false positive" pixels can be cleaned up using image processing operations embedded in OpenCV such as cvErode(), cvDilate(), cvFloodFill()[10]. These operations eliminate stray patches or pixels [10]. Though background subtraction is sensitive to lighting, it

can be used as motion detector in surveillance systems [10]. Using OpenCV and webcam, we can be able to create a low-cost surveillance system. Further research is necessary to filter out shadows and to have adaptive thresholding in order to have a robust surveillance system.

An important problem is how different face recognition systems are compared. One way to resolve this is to use the Matlab Programming and Artificial Intelligence.

VI. Conclusions and Recommendations

A neural based face recognition system is found to be invariant to changes in illumination for background and illumination conditions. One way to overcome this is through neural network training[11]. The feedforward back propagation do not have feedback connections, but errors are back propagated during training . During training, the net output is compared with the target value and the appropriate error is calculated[11] .

The face recognition system whether human or animal creature is implemented using a Matlab software package. In this method we use feedforward back propagation neural network[11]. It is an information processing system and has been developed as a generalization of the mathematical model of human recognition[11]. The function of a neural network is to produce an output pattern for a given input patterns when presented [11].

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