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Developing a Vision based Low Cost Surveillance System using Lab VIEW

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Abstract : A low end vision based surveillance robot is proposed hereof. The robot is fabricated from readily available components powered by four DC motors. When loaded with the floor plan and having being trained for unprecedented action, it sends an alarm to the security and starts uploading the images captured to the cloud. The security may choose to respond to the cause or reset the robot after scrutinizing the images on his monitor. The robot also has a smart charging feature. When tested in the academic premises of the university, the robot was found to function as per the desired efficacy. This technology is cheaper and much more efficient than the conventional CCTV systems in terms of efficient data processing, storage and interpretation.

Keywords : Pattern matching, Region of interest (ROI), cross-correlation, Machine vision.

1. INTRODUCTION

Video Surveillance System (VSS) is considered as an important security requirement to be provided at different public places. The primary objective of the VSS is continuous video steaming to a control room where trained personnel would observe for any suspicious activities. The current CCTV-VSS require high end cameras and transmission with a continuous human supervision to the surveillance data provided. This gradually lends the system prone to errors as even the best of trained personnel, while continuously monitoring tends to overlook some minor suspicious activities. Also, such huge data handling and storage requires very costly infrastructure.

Hence, here, an intelligent surveillance system designed with conventional webcam, driven by for servo motors powered by a rechargeable battery is proposed of specifically for unmanned zones.

Pedestrian detection is one of the most challenging and significant tasks in the computer vision field. Most of the robotics, intelligent vehicles, surveillance based applications developed so far in recent years have still a challenge of pedestrian detection.[1]. Currently the night vision systems uses Far Infrared (FIR) imaging system and Near Infrared (NIR) imaging systems. Far infrared imaging is based on the sensing the temperature of an object. This method works best in case there is a significant difference between the environment temperature and body or object temperature. But in reality in summer environment temperature will be near to human body temperature. Therefore there is not much difference between the object temperature and the environment temperature, this gives limitation to the effective use of the Far Infrared imaging (FIR).And in reverse situation such as in winter, most of the pedestrian uses heavy cloths which covers most of the body area hence adds the limitation to the camera to sense the temperature.

Most of the techniques developed for detection of a person

Most of the pedestrian detection techniques were developed under day light environment with a normal visible camera. Compared to day time, chances of accidents are more at night time. Attending more interest in road safety, detecting pedestrians on the roads, while driving at night time had gained more

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importance. In recent years, there has been more research on detecting pedestrians in night time for assisting vehicle drivers with advanced systems [3-6]. In general, vision based cameras were used in surveillance applications where conventional background subtraction method is used for Region of Interest (ROI) generation which fails since it is a moving background.

2. METHODOLOGY

2.1. Image Pre-Processing

It is always important to pre-process the image that we are getting from the live feed of the camera. Pre-processing of the image have many advantages and Images here are captured and processed at the rate of 30 frames per second. First step in this is to auto calibrate with the ambient light such that any shining object present in image will get filtered to normal intensity. Next to reduce the burden of the computation of the algorithms and to add accuracy even more extent, region off interest (ROI) has been defined. Region of interest is defined on adaptive and most efficient way. Here mainly the nearest and shortest part of image is been cropped and with that only the template image is compared. Once the matching score goes less than the threshold value which is set by user then ROI will be redefined to cover maximum area of source image.

The pattern matching block gives the result in the form of cluster which can be unbundled to find the parameters such as score, bounding box, angle, X,Y coordinates of the template image. Indicator light indicates the detection of unusual activity.

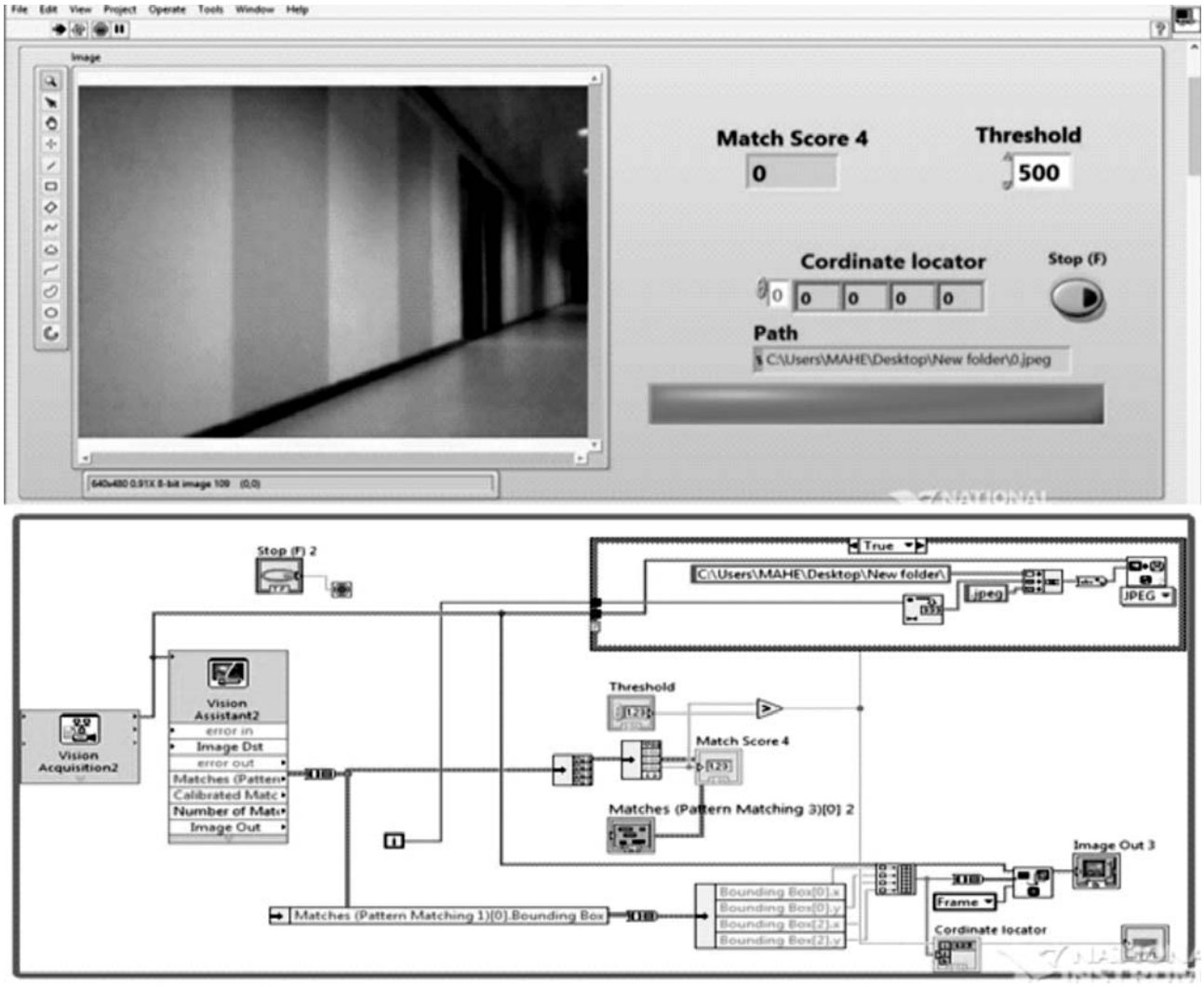

Figure 1: Graphical user interface developed in LabVIEW and Vision assistant

Program developed on LabVIEW platform with the use of machine vision toolbox and vision assistant. Use of vision assistant gives the ease in graphical programming. Vision acquisition express vi is used for the interfacing of camera in which all the setting for Image acquisition is done and camera attributes are tuned accordingly. In this vision assistant toolbox pre-processing and main algorithms is being designed as mentioned for this surveillance application.

2.2. Pattern Matching

In most of the machine vision applications pattern matching is one of the most useful technique. Here multiple pattern matching is technique with limited no of pattern is used to detect the unusual activity. Multiple pattern matching is being used with adaptive and optimized selection of pattern. Pattern matching tool is based on normalized cross-correlation, and it is the best way to find the template in an image [7]

3. SIMULATION AND EXPERIMENTAL RESULTS

Here live testing of designed algorithms has been carried out under various lightning conditions. Also a detected template and frames have been stored as an image at user defined location. In this testing work it is found that rotated and multiple pattern of a different persons can be treated as a biological model. A human entering in the restricted area is notified by a display on front panel. A screenshot of a vision assistant with template detection is shown in fig 2.

In this vision assistance it is flexible to define the minimum score of template matching to add the tolerance in object tracking. As shown in screenshot below in a front panel a person is detected in restricted area. As person is detected by the result of multiple template matching, indicator on the front panel turns red. This result which is indicated can be used to trigger the alarm or to close the exit doors.

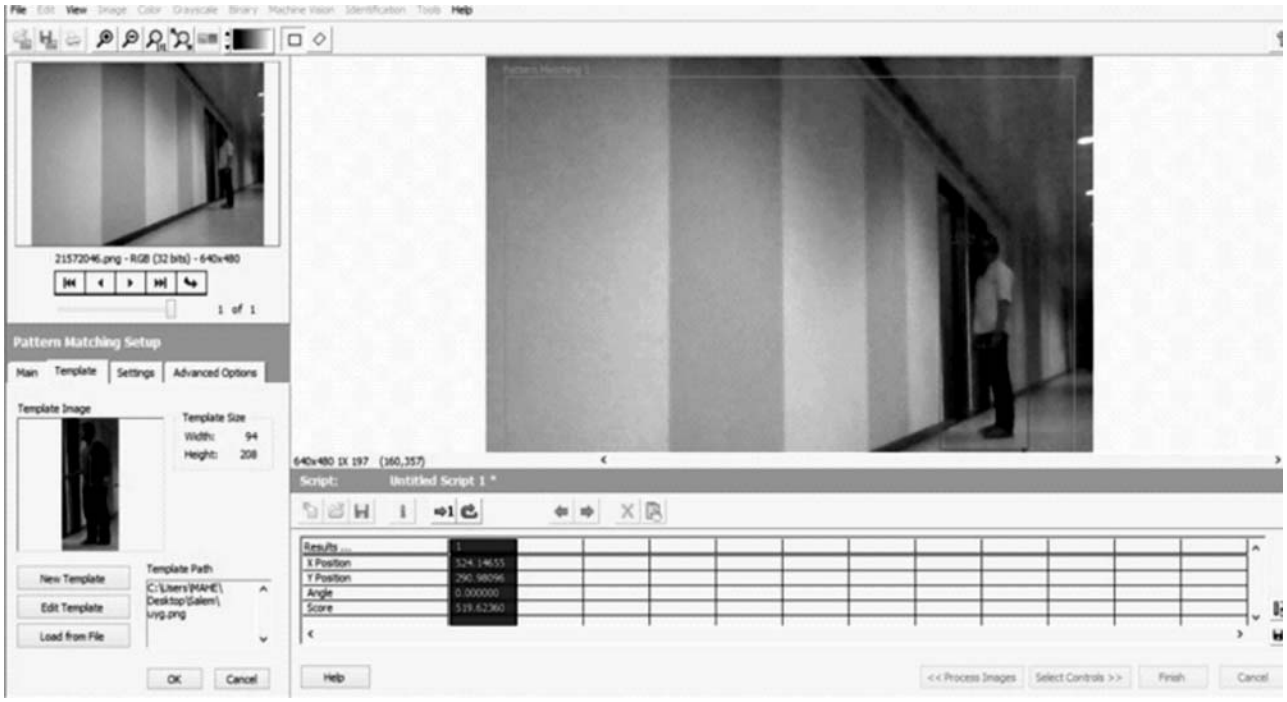

Figure 2: Template mapping with detail result in NI Vision assistant

An overlay function is used to highlight the person in live video stream. Also along with this an indicator which turns red based on the comparing the value of matching score and threshold value. The result of pattern matching also gives the coordinate values of the template detected. The Boolean result is used to trigger the frame/image saving option. Here we can see that only the instances only got captured and not for the entire duration.

Figure 3: Template matching and person 1 detection with overlay function

Figure 4: Template matching and person 2 detection with overlay function

Hence we can even further restrict the unnecessary utilization of memory space. Here threshold value is set by visualizing many cases at different lightning conditions.

4. CONCLUSION

Security is essential factors and can be easily achieved by the image processing techniques mentioned in this research work. Further networking of such multiple units can be formed for large area surveillance. Also Networking and online video streaming for remote area surveillance can be done easily with same algorithms developed. Ambient light difficulties have been overcome till certain extent. Same data can be uploaded on cloud for online storage and access. Surveillance technique discussed above is more cost effective and efficient. Ambient Same machine eye developed here can be fixed on moving robots or moving aerial drones. The moving frame calibration for fixing machine eye on robots is needed to be focused in future work of this surveillance.

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