Abstract: This paper basically emphasizes on different methodologies that have been proposed from past few years on object detection. Research on detection has widely covered applications such as artificial intelligence, robotics, security surveillance, identification, face recognition, detection of vehicles in traffic and many more. These applications led to untiring efforts for further techniques yet to be proposed. This paper enlightens us about numerous techniques that have extensively being used for detection in videos.

Keywords: Object detection, Background subtraction algorithm, FPGA, Micro blaze.

I. INTRODUCTION

Earlier used traditional systems which employed manual methods of detection were based on subjective analysis and judging that resulted in low accuracy and sometimes wrong results. The idea of computer vision brought many techniques which integrated various other technologies [1]. Object detection and tracking help us in video surveillance, object detection and tracking help us in video surveillance, as a pixel in the previous frame, and the pixel in the current frame have moved by a certain distance. By using the object detection and tracking we can able to architecture design in retail space instrumentation by learning the shopping behaviour of customers by tracking. In robotics also it plays a key role [3, 7]. Tracking is also an initial step or we can say a basic technology to extract regions of interest and video object layers as defined in different image formats (i.e. JPEG-2000 and MPEG-4 standards). Even though it is essential to many applications, robust object tracking under uncontrolled conditions still poses a challenge [6]. In real-life systems also helpful, and are required to track objects not only when the background of image is constant but also when lighting changes suddenly, motion of camera becomes large, also colour contrast becomes low, image noise soars to an unacceptable level, etc. In addition, if we are considering the real-time conditions than the computational complexity must keep minimum for real-time performance [2].

II. REVIEW OF PREVIOUS ALGORITHM

There are so many approaches for moving detection object, here considering the optical flow, the temporal difference and background differencing.

1. Optical Flow Method: In a video frame, the field of motion vector per pixel or sub pixel is called as flow of optical. There are so many methods by using those we can compute optical flow among which few are partial differential equation based methods, gradient consistency based methods and least squared methods [3]. The objective in optic flow calculation is to find the two-dimensional motion in an image sequence. As a pixel at location \((x, y, t)\) with intensity \(I(x, y, t)\), than will have moved by \(\delta x, \delta y\) and \(\delta t\) between the two frames the equation can be given:

\[
I(x, y, t) = I(x+\delta x, y+\delta y, t+\delta t)
\]

Assuming that the movement is small enough, the above equation can be derived by using Taylor series as well. The main disadvantage of this optical flow is that due to high computational cost [6].

2. Temporal Difference Method: The Frame difference is a part of background difference. In frame difference the current frame is simply subtracted from the previous frame, and the pixel values are different for different frames. A major drawback of this method is the interior pixels; these interior pixels are interpreted as part of background. Another flaw is that the objects must move continuously [2, 5]. This temporal differencing method is very adjustable to dynamic environments, but this method fails to extract all relevant pixels. Therefore we are using background differencing algorithm instead of these methods [2].

Final Conclusion

This paper is organized as follows in the section I. Introduction to object detection in video surveillance and in the section II. Previous algorithms and disadvantages after that in section III. Moving object detection in this we had compared the different techniques of background subtraction algorithm for object detection in section IV. Finally conclusion.
Moving object detection is at the bottom of the whole Video Surveillance system, and it is the foundation of some other advanced processes, such as objects classification and behavior understanding and so on. Owing to this, it is always the hot issue in the vision surveillance field. Moving objects detection judges the image changes from the video stream, and detects whether there are moving objects existing in the sequence images captured from the camera, then if any, it can extract them immediately [5]. However, because of the change of background, such as weather, lighting, shadow and some other small unimportant objects, it makes the moving objects detection difficult.

Anu Susan Philip “Background Subtraction Algorithm for Moving Object Detection Using Denoising Architecture in FPGA” [15,17] in this paper the Detection of moving objects is a very important task in mobile robotics and surveillance applications. In order to achieve this, we are using an alternative means for real time motion detection systems. This paper proposes hardware architecture for motion detection based on the background subtraction algorithm, which is implemented on FPGAs (Field Programmable Gate Arrays). For achieving this, the following steps are executed: (a) a background image (in gray-level format) is stored in an external SRAM memory, (b) a low-pass filter is applied to both the stored and current images, (c) a subtraction operation between both images is obtained, and (d) a morphological filter is applied over the resulting image. Afterward, the gravity center of the object is calculated and sent to a PC (via RS-232 interface). The direct execution of hardware algorithms in an FPGA provides speed-up factors typically between 10 and 100 times in comparison with the same algorithm implemented in software, using conventional microprocessors. [17] In this paper, a background subtraction algorithm for motion detection has been implemented in FPGA based board. To accomplish this, a gray level background image is stored in an external SRAM memory (allocated in the FPGA based board). The system performs a post-processing by filtering both the current frame and the background, using spatial convolution before the subtraction. After the subtraction has been performed, the resulting image is segmented using a threshold, and afterward a morphological filtering is applied in order to eliminate the noise of the last stage. Finally, the object’s gravity center is calculated and the same is sent to a PC via an RS-232 interface. The RS-232 interface was chosen due to the fact that data traffic is only related to object’s position and, therefore, the performance is not affected. The system works on a real-time pipelined flow. Additionally, the system is capable to detect an object by extracting its shape and calculating the gravity center. The object position is send to a PC or another platform via RS-232 interface. On the other hand, synthesis results show that area consumption is low, using just 10% of logics elements of FPGA for the overall moving object detection system, allowing the implementation of this system over low-cost FPGAs. The system presents a low-cost architecture that high resources, like memory, are not needed. This fact shows that the implementation of this system on low-cost FPGAs is possible, and it presents good results. [15].

S. Nazeer Hussain K. Sreenivasa Rao, M.Tech, (Ph.D.) S.Mohammed Ashfaq “The Hardware Implementation of Motion Object Detection Based on Background Subtraction” There are many challenges in developing a good Background Subtraction algorithm. First, it should be robust to the changes in illumination. Second, it should avoid detecting non stationary objects like papers and shadows. This paper presents a new algorithm to detect moving objects with in a scene acquired by a stationary camera the output data provide a scene characterization allowing a simple and efficient pixel-change detection framework.[16]. This yields a good trade-off in terms of robustness and accuracy, with a minimal cost in memory and a low computational complexity. In this paper, a video surveillance-based image processing system is developed on Xilinx Spartan3 Field Programmable Gate Array (FPGA) device using embedded development kit (EDK) tools from Xilinx. The 32-bit Micro Blize processor is chosen because of the flexibility. Background Subtraction-based reconfigurable system is designed using the EDK tool. Hardware architectures of Motion human detection algorithm have been implemented as a coprocessor in an embedded system. The hardware cost of this architecture is compared for benchmark images.

Mayur Salv, Mahesh Rajput, Sanket Shingate “Fpga Based Moving Object Detection Algorithm Implementation for Traffic Surveillance”, in this paper the detection of vehicles by background subtraction technique and the automatic surveillance of traffic based on the number of vehicles. The algorithm takes into consideration three main techniques namely Background Subtraction, Edge Detection and Shadow Detection. Background Subtraction block is sub-divided into Selective and Non-selective parts to improve the sensitivity and give accurate background. Edge detection helps to detect the exact boundaries of moving vehicles. This is followed by the shadow detection block that removes the falsely detected pixels that are generated due to shadow of the vehicle. By analyzing the output of the blocks discussed above, the final mask is generated. The mask along with the input frame is processed to give the final output frame where the detected object is highlighted. Furthermore, parameters such as number of blobs per frame (vehicles) and the area of blobs can be used for traffic surveillance. The algorithm of object detection is implemented on FPGA using VHDL. Spartan-6 Development Board is used for implementation of the same. The novel combination of masks from selective and non-selective background improves the detection quality.

Jones Y. Mori et all “An FPGA-Based Omnidirectional Vision Sensor for Motion Detection on Mobile Robots” This work presents the development of an integrated hardware/software sensor system for moving object detection.
and distance calculation, based on background subtraction algorithm [4]. The sensor comprises a catadioptric system composed by a camera and a convex mirror that reflects the environment to the camera from all directions, obtaining a panoramic view. The sensor is used as an omnidirectional vision system, allowing for localization and navigation tasks of mobile robots. Several image processing operations such as filtering, segmentation and morphology have been included in the processing architecture. For achieving distance measurement, an algorithm to determine the center of mass of a detected object was implemented. The overall architecture has been mapped onto a commercial low-cost FPGA device, using a hardware/software co-design approach, which comprises a Nios II embedded microprocessor and specific image processing blocks, which have been implemented in hardware. The background subtraction algorithm was also used to calibrate the system, allowing for accurate results. Synthesis results show that the system can achieve a throughput of 26.6 processed frames per second and the performance analysis pointed out that the overall architecture achieves a speedup factor of 13.78 in comparison with a PC-based solution running on the real-time operating system xPC Target[4,12]. This work has presented a FPGA-based omnidirectional vision system for mobile robotic applications. It takes advantage of a pipeline approach for processing the polar image, using a background subtraction algorithm. The overall latency of the motion detection architecture is 385.607 clock cycles, and after this latency, the system has a throughput of 26 frames per second (running at 10.2 MHz). The proposed architecture is suitable for robot localization, allowing computing the distance between the robot and the surrounding objects. Synthesis results have demonstrated that the proposed hardware achieves an operational frequency around 10.2 MHz. [11]. A video surveillance-based image processing system is developed on Xilinx Spartan3 Field Programmable Gate Array (FPGA) device using embedded development kit (EDK) tools from Xilinx. Two different hardware architectures of two dimensional (2-D) video surveillance have been implemented as a coprocessor in an embedded system. [11] It is direct implementation of video surveillance by Motion human detection algorithm. In addition, the hardware cost of these two architectures is compared for benchmark images.

C. Sanchez-Ferreira, et al “FPGA Implementation of Background Subtraction Algorithm for Image Processing” Before the subtraction of two images the pre-processing is done using the median filter. After the subtraction is done the segmentation is performed using threshold value. Once the segmentation is completed the morphological filtering is performed on that image to remove the unwanted blobs. System is designed using MATLAB/Simulink block sets. In MATLAB/Simulink the system generator token is used to convert Simulink model logic into the VHDL code which makes it compatible with FPGA. Using the system generator token VHDL code is generated. That VHDL code is synthesis in the Xilinx 14.1 and then .bit file is downloaded to the Virtex-5 board through JTAG cable and the output image is display on the VGA monitor which is interfaced with Virtex-5 board using DVI connector. [12]

M. Surumbar Khuzhali, “Back Ground Subtraction Algorithm for Moving Object Detection in FPGA” There are conventional as well as improvised edge detection algorithms depending on the application. Paper proposes a new method to detect moving object based on background subtraction. First of all, we establish a reliable background updating model based on statistical and use a dynamic optimization threshold method to obtain a more complete moving object. Image segmentation is a technique and process which divide the image into different feature of region and extract out the interested target. To illustrate the level of the image segmentation in image processing, we have introduced “image engineering” concept , it bring the involved theory, methods, algorithms, tools, equipment of image segmentation into an overall framework. With the improvement of computer processing capabilities and the increased application of color image, the image segmentation are more and more concerned. This article proposes an image segmentation method based on the traditional seed region growing algorithm. The system works on a real-time pipelined flow, providing one pixel per clock cycle (23.03 MHz) after the initialization latency period (33.50 ms), making possible to process 800 x 480 images in a rate of 60 fps. [19]

Ms. Anjali Kondane et all “Hardware Solution to Motion Object Detection Using Morphological Filtering and FPGA”, in this paper presents an innovative and unique hardware solution using morphological filtering technique [20] and we observe an output on visual basic hyperlink terminal. This solution is based on micro blaze architecture of Spartan 3 EDK FPGA. Field Programmable Gate Arrays (FPGA) are commonly used for implementing complex image processing algorithm applications.

S. Nazeer Hussain K et all “Implementation of Running Average Background Subtraction Algorithm in FPGA for Image Processing Applications”, Running average algorithm was chosen because of low computational complexity which is the major parameter of time in VLSI. Involves three important modules background modelling; adaptive threshold estimation and finally fore ground extraction. Compared to all existing algorithms our method having low power consumption and low resource utilization. Here we have written the core processor Micro blaze is designed in VHDL (VHSIC hardware description language), implemented using XILINX ISE 8.1 Design suite the algorithm is written in system C Language and tested in SPARTAN-3 FPGA kit by interfacing a test circuit with the PC using the RS232[16].
Shen Hao “Moving object detection in aerial video based on spatiotemporal saliency”, in this paper they had Proposed a novel hierarchical moving target detection method based on spatiotemporal saliency. Temporal saliency is used to get a coarse segmentation, and spatial saliency is extracted to obtain the object’s appearance details in candidate motion regions. Finally, by combining temporal and spatial saliency information, we can get refined detection results. Additionally, in order to give a full description of the object distribution, spatial saliency is detected in both pixel and region levels based on local contrast[14]. Experiments conducted on the VIVID dataset show that the proposed method is efficient and accurate.

Mohamed Dahmane et all “Real-time moving object detection and shadow removing in video surveillance”, in this paper they had proposed a fast and flexible approach of movement detection based on an adaptive background subtraction technique with an effective model of shadow elimination based on color constancy principle in RGB color space. The results show the robustness of the model and particularly its capacity to work in a completely autonomous way. As in any modular conceptions, the test of the real performances of an algorithm must be carried out in its global context; it’s why a complete automatic monitoring system was elaborated. However, in this article the emphasis will be put on the detection part. [8, 7]

Mr. Mahesh C ET all “Detection of Moving Object Based on Background Subtraction”, in this paper they had proposed the implementation of an efficient object detection algorithm that can be employed in real time embedded systems due to its fast processing. This paper proposes a new method to detect moving object based on background subtraction. [21] Morphological method is used for further processing to remove noise and to preserve the shape of moving object [20]. Convolution operation is applied to the binary image so that parallel architecture of embedded system will produce result very quickly. Binary image is convolved with binary numbered mask, causes limited memory requirement which is allowing the implementation of this system over low-cost FPGAs. [21]

IV. APPLICATION

1. Automated video surveillance: In these applications computer vision system is designed to monitor the movements in an area, identify the moving objects and report any doubtful situation. The system needs to discriminate between natural entities and human, which require a good object tracking system.

2. Robot vision: In robot navigation, the steering system needs to identify different obstacles in the path to avoid collision. If the obstacles themselves are other moving objects then it calls for a real-time object tracking system.

3. Traffic monitoring: Traffic is continuously monitored using cameras. Any vehicle that breaks the traffic rules or is involved in other illegal act can be tracked down easily if the surveillance system is supported by an object tracking system.

4. Animation: Object tracking algorithm can also be extended for animation.

5. Magnetic Resonance Imaging (MRI): Doctors can get highly refined images of the body’s interior without surgery. MRI is particular useful for imaging the brain and spine, as well as the soft tissues of joints and the interior of bones.

V. CONCLUSION AND FUTURE WORK

In this paper, various algorithms of background subtraction have been discussed. A very good idea about various techniques used Background Subtraction method is shown in this paper. As per study non recursive methods are simple in terms of implementation but they lack in terms of accuracy. Accuracy can be achieved by recursive techniques. Speed is also a major factor. The techniques which are mainly affected by it are discussed in this paper.

REFERENCES


