Object tracking based stereo vision

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Abstract. In this paper, we described a new method for moving objects (detection and tracking). The first step to determine the object tracking is the segmentation process through getting a background image and then comparing it with the foreground image. Separation of the background image from the foreground image is the result of this step to obtain an object. In further step, enhance the segmentation operation by using morphology to remove small noise. Finally, select the largest object, center and radius of the largest. Therefore, we can detect the object perfectly and then the tracking of all objects. In this process for finding out the location of the target, we observed less error in detection and was very accurate.

I. Introduction
Moving detection has been an important topic of researchers for a long time. Two-dimensional cameras, Lidar or other 3D sensors using of point cloud and vision are all methods used for moving tracking and detecting of objects (Sethian, 1999) (Cohen, 1991). Stereo vision aims at reproducing the human ability to infer information on the 3-D structure and distances of a scene from images taken from two different viewpoints (Huber, 1994) (Trucco & Verri, 1998) (Holonec et al., 2014) (Ginhoux & Gutmann, 2001). Moving objects recognition is one of the most important tasks in many applications such as monitoring, camera-only active safety systems, intelligent autonomous vehicles, and robotic vision. Detection and recognition are two tasks, one related to the other. Detection finds the location and size of moving objects in a normal scene image while recognition tasks classifies the detected moving objects under their categories. There are many challenges for recognizing moving objects such as walkers due to lighting variations, crowded background, and articulation partial occlusion (Vu et al., 2016) (Szelski, 2010).

II. Related Work
Detection and tracking are two important components of monitoring systems. There are several ways to detect the object's movement (Patel & Thakore, 2013). Keven Nickels and Eric Huber discussed camera ego-motion estimating by using inertial measurements. This estimate was used for augmenting stereo tracking. This method was efficient in terms of speed. The disadvantage of this method, the estimate location was inaccurate (Nickels & Huber, 2001). Sam Schauland, Joerg Velten, and Anton Kummert proposed wave digital filter (WGF) to detect the object's moving in an assured direction at a given speed. They pointed out the separation of three-dimensional signals focused on different or directional components. In this study, they proved a good performance for motion-based object detection. It has disadvantages, it is required to be sensitive to dynamic change, detection method it has required a large amount of calculation (Schauland et al., 2008). Sunil Kumar Vengalil and Neelam Sinha proposed the system which is based on Texture Detection Algorithm (Zhou et al., 2015). They modelled using PCA basis vectors and a $l_2$ regularized least square method. Hong-Son proposed the system which is dependent on background subtraction to detection object. This development was an efficient pedestrian detection method (Vu et al., 2016). Hao Sun, Zehui Meng, Xiaotong Shen, and Marcelo H. Ang Jr. designed an efficient system to navigate indoor environments in crowded and narrow paths, which were implemented and tested on an omni-directional mobile.
robotic base. The object's moving detection depended on predication and estimation. This study was robust and rapid when applied to real mobile manipulation applications (Sun et al., 2016).

III. Propose Method
In our proposed scheme, we are using new method to detection module and object tracking using the operation (segmentation, enhancement, sorting, choice largest and center to detect objects, finally tracking of objects as in algorithm (1.1) and in figure 1 below.

The main algorithm (algorithm 1.1) of the system as follows:

| Algorithm (1.1): object tracking |
|----------------------------------|
| **Input:** Prober background object (IB), number of new images(N), new images (IW) |
| **Output:** - detect target by drawing a green circle |
| - object tracking of the target. |
| 1. segmentation by threshold |
| subtract background image from input image & select pixels with a big difference (compared between background image and foreground image) |
| I foreground = |IW red - IB red| > 10 |
| |IW green - IB green| > 10 |
| |IW blue - IB blue| > 10 |
| 2. Enhance the segmentation operation by using morphology to remove small noise. |
| 3. Select the largest object |
| Using a bubble sort algorithm to sort from largest to small in case there are more than one object |
| For i = 1 : H-1 |
| For j = i+1 : H |
| if st(i).Area < st(j).Area |
| T = st(i); |
| st(i) = st(j); |
| st(j) = T; |
| T = id(i); |
| id(i) = id(j); |
| id(j) = T; |
| end |
| end |
| 4. Select center and radius of the largest object. |

This algorithm consists of four operations (segmentation, enhancement, sorting, choice of the largest and centre of objects). The segmentation operation is done by subtracting the background image from the foreground image to obtain objects. Then, the enhance operation to remove noise from objects. After that, sorting the object and choosing the largest object. Finally, select the center and the radius of the largest.
IV. Experimental Result:
The implementation details of the proposed method is described as follows:

**Input:**
1- background image

2- twenty nine images of ball in a different direction

**Output:**
The execution in matlab program is that 29 images of a ball in a different direction are detected by a green circle. Figure 2 shows testing 29 images of ball sequences containing objects as follows:
Figure 2. Object tracking
Above Figure 3 shows the experimental results. The horizontal line is the X-axis and the vertical line is the Y-axis. By the proposed method, the inputs are one background image and 29 images of a ball. We have shown the tracking of a ball and how it’s ball moves from top to bottom. In this process, find out the actual position of the balls without any error and the detection is accurate.

V. Conclusions
This paper presented a new approach for object recognition and tracking using data from a stereo vision system. This approach arrives at object tracking through operations (segmentation, enhancement, sorting, choice of largest and centre of objects) to detect the object perfectly. It is noticed from the results that the error is less, and the detection was very accurate when we entered more than 28 images of the balls.

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