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Night Vision Based Optimum Robot Path Planning In Rescue Operations

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Abstract—This paper presents a novel approach for optimum shortest path planning at night for a robot based rescue operations. Once the obstacle is identified, the next step is to find the position of the obstacle (even moving), identify the optimum robot path for navigation. Next,applying the Blob analysis,to find the position of the obstacle. Later, by using Line algorithm, lines are drawn from source to destination position of the robot.The robot's optimum shortest path is computed by adopting obstacle slope line detecting technique. Hence,the robot takes an optimum path for its navigation.

IndexTerms— Blob,Optimum,Path Planning,Robot.

I. INTRODUCTION

The constant monitoring of some systems like military applications, nuclear reactor, etc. are needed the robots to accomplish good performance increasingly. The Robot works continuously exclusively of any error in the outcome. Physically monitoring of the robot continuously is a very thorny job. Making robots autonomous are a great triumph. The robot has to execute the any particular task by itself; it requires its own path plan, by avoiding the obstacles continuously to complete the task [1].

The Robot Path Planning in non-static environment task having two important tasks they are found in local allowable path and keeping a coincident result [2]. A real-time collision-free robot-path planning works in real time and it does not need prior awareness of target or barriers movements. When the barriers are at a halt, this algorithm finds the robot contagious the target, providing the robot moves at a higher speed than the target, and the vigorous-system update frequency should be large[3]. Path planning algorithms like A*, D* Lite and Uniform Cost Search were implemented and later combined to direct the robots from its initial position to destination. A method that reduces obstructions was given for handing over the parking location on a specified floor for incoming cars [4, 5, 6].

In an adaptive robot path-planning control method, the robot can progressively reach the target depending on the detecting of obstacle, obstacle evading in its path, robot's rotation by itself, and finding the robot's position for selection [7]. An improved planning method could prevent mobile robots from oscillation and dead circulation successfully and ensure the accessibility to the global goal [8]. When the robot's path and surroundings are represented by a topological created map, afterwards the space from the goal to the whole robot workspace will be delivered successfully [9].

II. THE WORKING PRINCIPLE

The figure 1 shows the working principle of robot path planning. At the beginning set the camera in a surveillance area and trigger the camera to capture the video later convert into frames (images). It needs to convert the frames to binary for further processing. Find the difference between successive frames to find the moving obstacles in a surveillance area. If the difference is zero means that there is no moving obstacle, otherwise obstacle is present. If an obstacle is present traced that and determine the pixel values (both x and y directions) by labelling the tracked obstacle.

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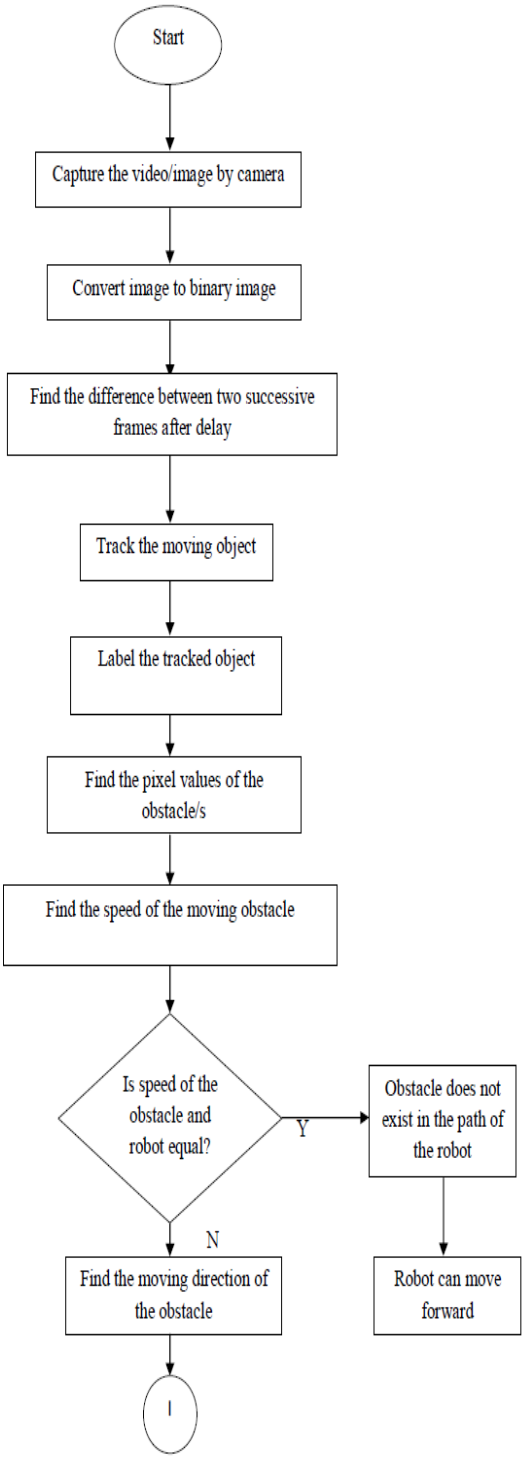

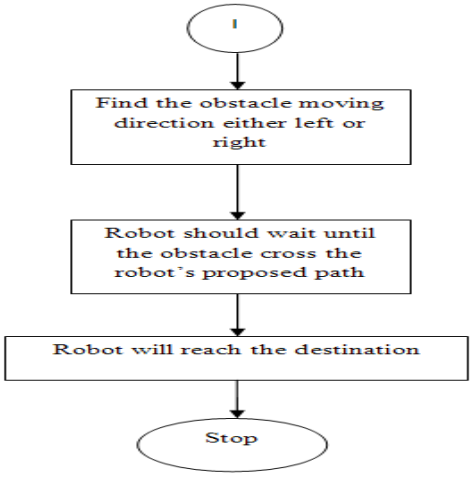

Figure 1.The Working Principle.

For the aim of path forecasting, the obstacle moving direction and speed should be found. If both the speed is equal and also the position of the robot and obstacle are known, the robot may reach the destination. If variable speed exists, especially the robot's speed is lower than the obstacle, the path will not exist and otherwise the path will exist. The existence of the robot path is entirely depends on the position of the moving and static obstacles

III. Results And Analysis

The figure 2 shows the region of interest where stationary and moving obstacles are present. In which the collision free path should be established.

Figure 2. The Static obstacles in the ROI of the robot

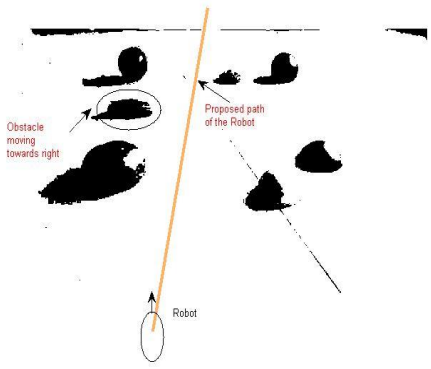

Figure 3.The moving obstacle in the Robot's proposed path.

The figure 3 shows the moving obstacle towards right

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through the robot's proposed path to destination. Figure 4 and 5 depict the moving obstacle in two different positions towards right along with the static obstacles.

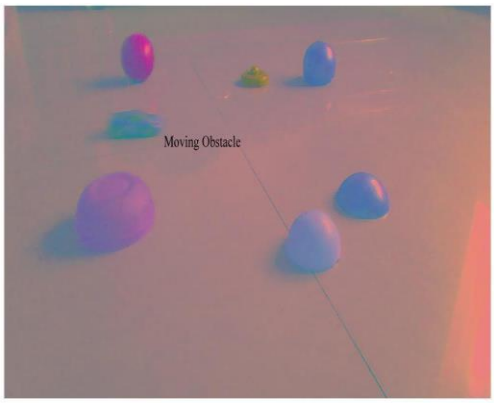

Figure 4. Moving obstacle path position 1

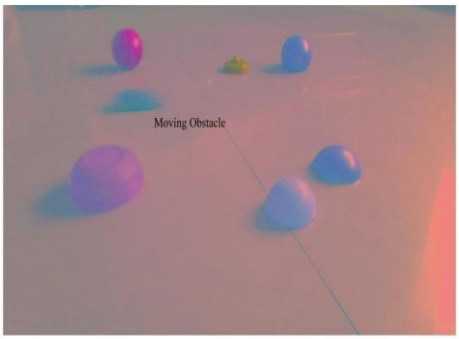

Figure 5. Moving obstacle path position 2

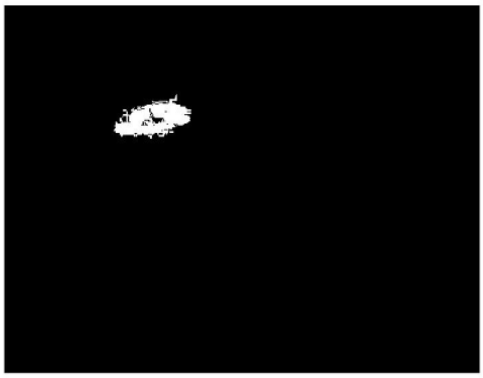

Figure 6. Difference between two successive frames 1 and 2.

The figure 6 shows the result of the frame difference between the two successive frames as shown in figures 4 and 5 respectively. The non-negative value of the frame difference decodes that the obstacle is in motion.

The Speed of the moving obstacle is calculated as:

Speed = Distance/Time ---*(1)*

Direction of the obstacle can be calculated as:

Direction = (x-coordinate pixel value of frame 1) – (x-coordinate pixel value of frame 2) -- (2)

If the result after calculation is negative indicates that the obstacle is moving towards the right, if not moving towards left direction.

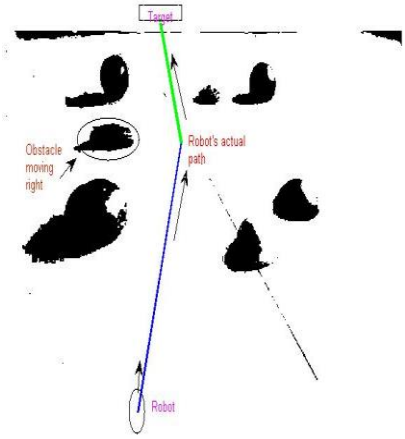

Figure 7.Robot avoiding the single obstacle.

To find the obstacle's position pixel values and speed, robot's position and speed are known. If an obstacle is nearer to the robot's proposed path, irrespective of the robot's speed robot will reach the destination and the obstacle has crossed the robot's proposed path before robot reaching nearer to the obstacle as shown in figure 7.

When two obstacles are moving in the opposite direction, even though the speed of the both the obstacles is known robot cannot reach the target as shown in the figure 8. In such situation robot has to wait for a while and then proceed towards the target.

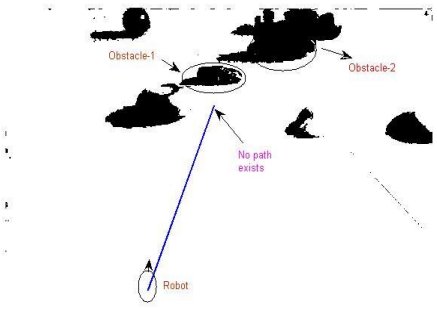

Figure 8. No path exists for the robot.

To avoid collision, the robot will wait nearer to the obstacle crossing its path until the time calculated to reach the proposed path as shown in blue colour. If the path is free,the robot will reach the destination as shown in green colour line in the figure 9.

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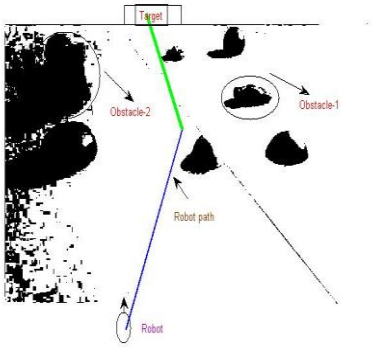

FIGURE 9.ROBOT PATH EXISTS BETWEEN TWO OBSTACLES.

IV. CONCLUSION

The Robot path planning algorithm for rescue operations has been developed. Depending on the speed and direction of the obstacle and also the speed of the robot, the pathplanning is designed. If obstacle comes across the projected path of the robot, the robot waited till the clearance of the path, the waiting time is depending on the speed and distance to cover by the obstacle. This algorithm is planned using MATLAB tool and the results are compared with A-star algorithm.

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