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Target Assignment in Robotics and its Distance Optimality Using DDA Optimization in Image Processing

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ABSTRACT

Many difficult problems solving require computational intelligence. One of the major directions in artificial intelligence consists in the development of efficient computational intelligence algorithms, evolutionary algorithms, and neural networks. Some systems operate in isolation or cooperate with each other, some optimized techniques are used to resolve the mobile path planning, DDA is one of them. The behavior could emerge an intelligence called systems intelligence, and intelligence of a system. The shortest path planning approach and its optimization for the mobile robot in a static and dynamic environment are the major tasks in the field of Robotics. In the present day environment finding collision-free, the shortest path is the fundamental issue in the path planning. In the mobile robot, the processing time and reaching time is very important. The path time is to be reduced so that the complexity is reduced. During the process, it is found that few algorithms have its own advantages and disadvantages. Here we presented a DDA optimization technique for optimization.

INTRODUCTION

The area homeland robotics has assumed a greater importance in the present age and robots are now used extensively to rescue survivors from dangerous environments when dealing with hazardous substances. Here the substance is taken as image and the image is presented as obstacle[2]. The goal of the path planning method is to determine a sequence of configurations for the robot to move around obstacles and avoid collisions while reaching the desired goal [1]. The Digital Differential Analyzer (DDA) method is widely used for planning the path of the mobile robot. In a mobile robot path planning, researchers used many algorithms for optimization and DDA is one of them and is considered to be subjected to other methods. This has two sections: the first one is storing the location points in a vector array and the second one is resolving the array stepwise. In the DDA field method, we can imagine that all obstacles are represented by an image and we applied quadtree method on the image to make a tree[1]. Once the tree is formed the algorithm is applied. The distance from the robot to obstacles will be judged on the basis of the tree structure. The destination or goal is followed with NFT (Neighbor finding technique). Then we apply DDA on the path which is stored in the database which has the specific function and finally the line of the path is drawn. The function slopes down towards the target point so that the robot can reach the target by following the path.

THE APPROACH

We have implemented DDA on A* and NFT algorithm to get the optimization. It is simulated and the result is verified. The detail of the result and graph is shown in figure 3.

A. ***A*Algorithm***

A* algorithm based implementation is easier and practically faster. To reach the destination, A*algorithm creates sub-optimal paths using its neighbors. In A* representation, f'(n)

= g(n)+h'(n), where g(n) is the total distance from the initial position to the current position and h'(n) is the estimated distance from the current position to the goal destination/state. To create this estimation a heuristic function is used. f'(n) is the sum of g(n) and h'(n) and is stated as the current estimated shortest path.

B. ***NFT Algorithm***

QuadTree

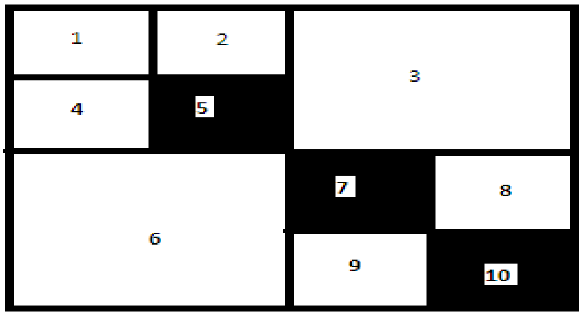

Fig 1 The image and its Notation

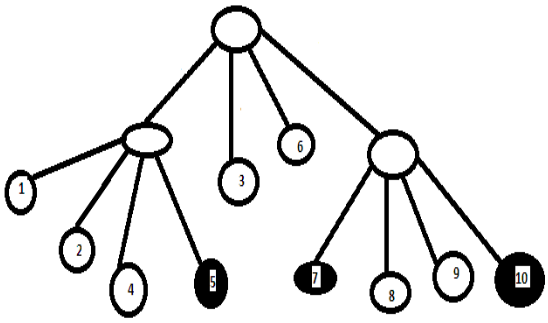

Fig 2 Representation of Quadtree

Image processing plays an important role in the field of robotics path planning. Here we have implemented the NFT (neighbor finding technique) and applied DDA optimization over the NFT with quadtree approach[1,2,3]. Here we have implemented, Equl_adj_neighobur,equal_corner_neighbour,
Gte_adj_neighbour,Getqual_adj_neighbour,Get_corner_neighbour.

C. DDA Optimization

Let the path followed by the quadtree algorithm be stored in an array P1. Let P1 contains N points.

1.Check from 0 first point in P1 third element, if a free path exists, if yes store in a variable called Var.

Note; Var initially contains 2nd element

2.Check the first point to 4 the point in P1 if there is a path then overwrite with the element.

3.Repeat the procedure until all the elements are scanned

in such a way.

4.Let the Kth element be stored in Var stored in a new array

[ ] . Now repeat the above four steps from Kth Variable.

If the Kth variable is (n = i)the of the P1[ ], then add these points in P(New).

5. T last get the point and get the path. As

```
    begin
For I = 0:n-2
    begin
for j = 2 ; n
    begin
if( path_bw(a [I ],a [j])
     begin
        var = a[ j]
end
```

```
    end
      b [++ counter] = var;
  end
      end
end
  b[++ counter]= a[n-1]
   end
```

OPTIMIZATION FOR OPTIMAL PATHFINDING

*C. **Application of DDAa optimization***

The DDA optimization network resolves the task to reach all the nodes on the map. The route from the starting node to the target node is resolved, but the solution is not optimal or close to the optimal. Different methods have been adopted to get the optimized path, DDA is one of them. For finding, an optimal route between the start and the end by using DDA Algorithm is presented in the following:

- Elimination of the duplicate nodes. If the number of neurons is equal to the number of nodes on the map, the network does not find the solution, because a set of neurons will not be active during the network training process.

- Finding the address from the resulted array vector with the starting and ending nodes.

- Comparison of the Array vector values, which correspond to node coordinates on the map, is done with start and end node positions.

- Finding the nodes for which a neighborhood node with a lower cost to the target node exists.

- Calculating the cost from the start to the end node and from the neighborhood nodes to the end node for each node found in the previous step and storing the results in a table with the following fields: current node index, neighborhood node index, and the calculated cost.

- Ordering the table in ascending order according to the cost column.

- Deleting the higher cost overlaps the section with a Lower cost.

- Finally extracting the closely optimal path from the start to the endpoint.

SIMULATED RESULT AND ANALYSIS

We have simulated A* and NFT algorithm with system configurations Intel® Core(TM) i3-3220 GHz 3.30, Ram-2GB (1.88 GB Usable) and system type-32 – Bit Operating system. We applied DDA optimization on the pathfinding and tested around 100 different locations i.e. different start and goal points. We have presented 10 outputs with its detail location, time and distance as shown in the fig 3and table1 and table 2. The comparison in graphical form is shown in fig 4.

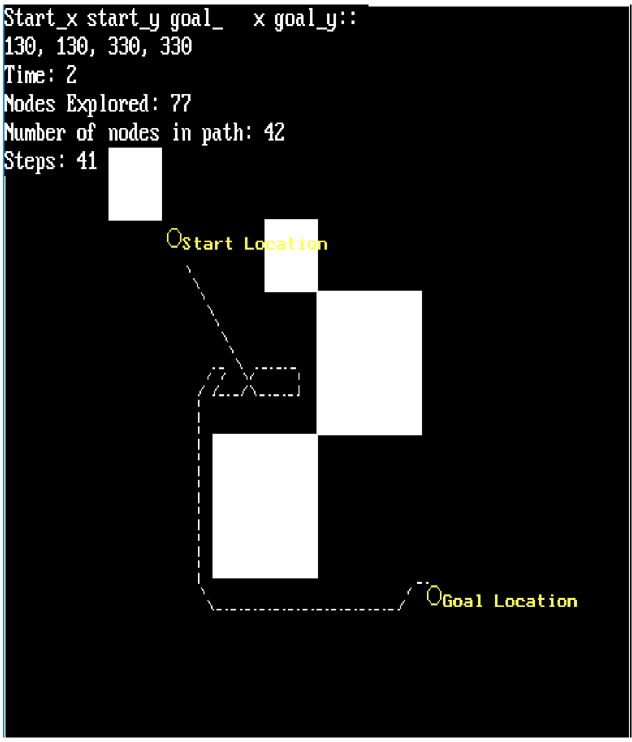

Fig 3 A* Grid Search Algorithm Result

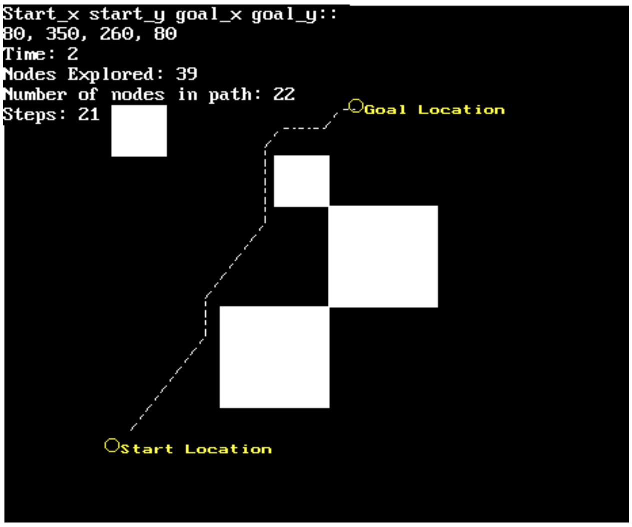

Fig 4 A* Grid search Algorithm Result

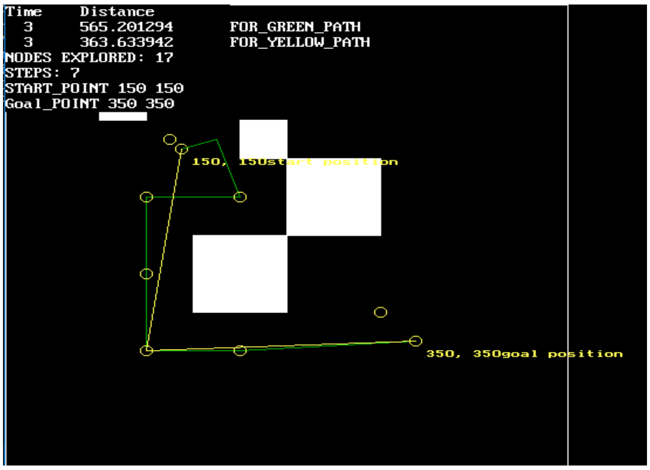

Fig 5 The NFT Algorithm Result

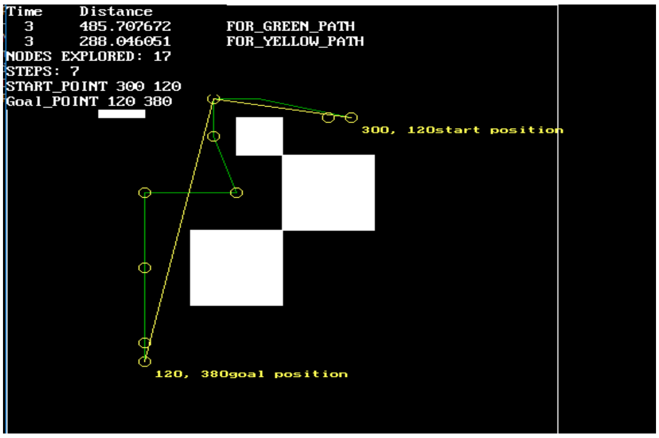

Fig 6 NFT Quadtree search Algorithm result

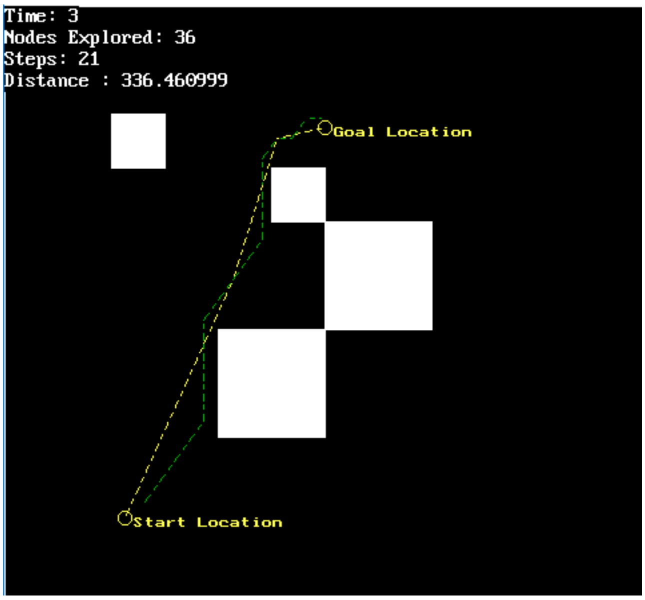

Fig 7 A* optimized Algorithm Result

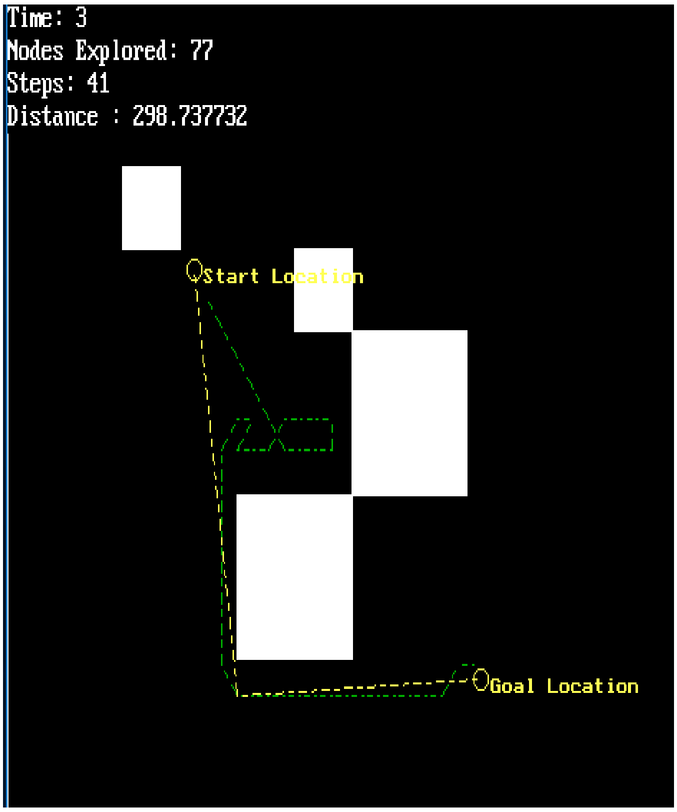

Fig 8 A* optimized Algorithm Result

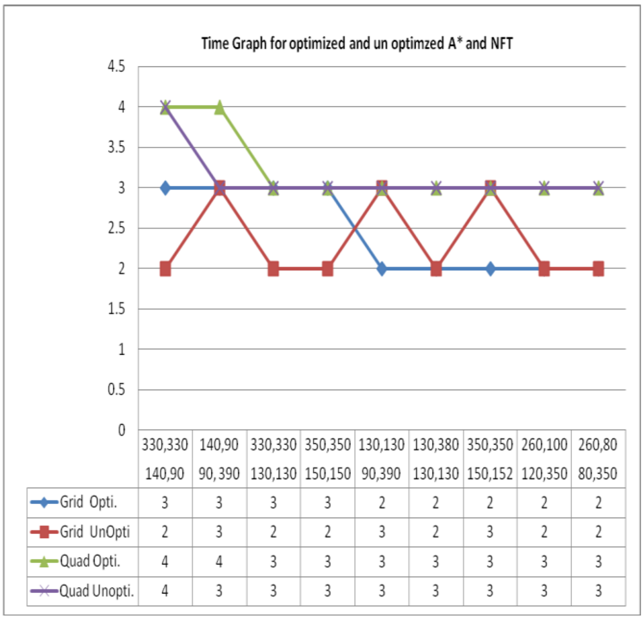

Table I Time and its graph is taken by the A* and NFT from Start to Goal Point

Serial No	Start Point	Goal Point	Grid Opti.	Grid UnOpti	Quad Opti.	Quad Unopti.
1	140,90	330,330	3	2	4	4
2	90, 390	140,90	3	3	4	3
3	130,130	330,330	3	2	3	3
4	150,150	350,350	3	2	3	3
5	90,390	130,130	2	3	3	3
6	130,130	130,380	2	2	3	3
7	150,152	350,350	2	3	3	3
8	120,350	260,100	2	2	3	3
9	80,350	260,80	2	2	3	3

Table II Distance took by the A* and NFT

Serial No	Start point	Goal Point	Grid Un opti	Grid opti	Quad Un opti	Quad opti
1	140, 90	330, 330	800.42043	406.83041	606.66217	403.181763
2	90, 390	140 ,90	299.404301	279.508484	307.263092	279.508484
3	130, 130	330, 330	559.010752	298.737732	567.652405	362.4644996
4	90, 380	240, 90	343.010752	336.4609	430.009308	326.156311
5	150, 150	350, 350	544.010752	295.853668	565.201	363.6339
6	90, 390	130, 130	250.803236	263.058929	264.728241	263.058929
7	130, 130	130, 380	240	125	251.209427	125
8	150, 152	350, 350	544.010752	295.853668	565.201294	363.633942
9	120, 350	260, 100	423.409677	334.588684	413.245544	312.856
10	80, 350	260, 80	338.61828	320.61417	428.5895	321.01
11	300, 120	120, 380	483.611828	507.457092	485.7	288.046

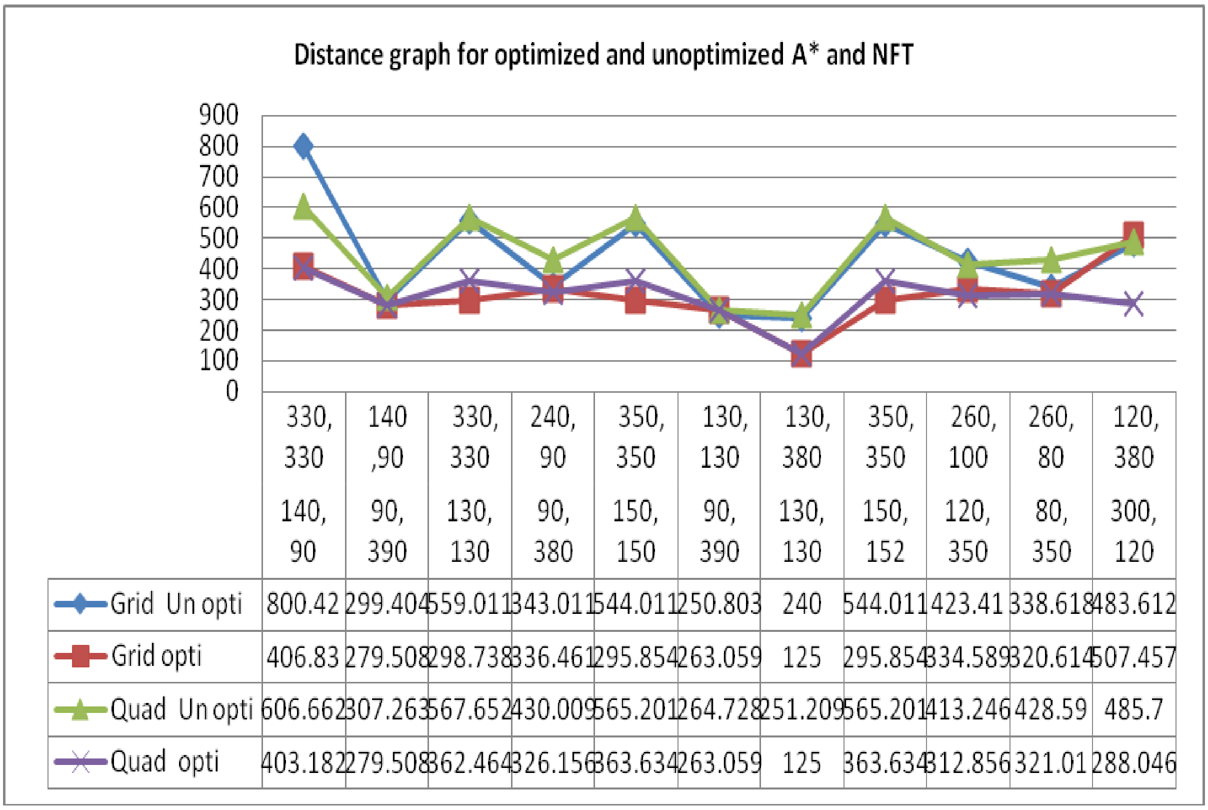

Fig 9 The Graph for Distance taken By A* and NFT

CONCLUSION

In this paper, we have implemented DDA optimization technique on A* and NFT algorithm and tested the result taking the different start and goal points. We found that the time and distance is reduced around 60%. The amount of the existing works for each approach has been identified, classified, and tested with C^{++} language. This paper divides the motion planning algorithms into two major groups, namely, the Conventional Approaches and Heuristic Approaches. The conventional approaches are Roadmap, grid search or Quadtree approach. Here we tested by heuristic method also and the result is shown. The discussion of the different approach in the field of robot motion planning is also presented, including different comparative figures and charts.

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