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An Improved Path Planning REB Mechanism for Rescue Robot in Unmanned Area

M. Karthiga[1], S. Justin Samuel[2]

[1]PG Student, Faculty of Computing, Department of Information Technology Sathyabama University, Chennai, India

[2]Professor, Faculty of Computing, Department of Information Technology Sathyabama University, Chennai, India

Abstract: ***Humans in disaster areas facing harmful issues by the failure of rescue guards. Often rescue robot themselves face problems to track the exact position for humans in their environment. To overcome these problems an improved path planning mechanism is introduced to detect the struggling human in unmanned areas like disasters, war field, rival nations, etc. A new method of Rapidly Exploring Blocks (REB) is implemented in this work to alternate the robot path from harm position. REB helps rescue robots to move in disasters space and guides to find the all humans.REB mechanism also allows rescue robot to move in collision free path. REB rapidly explores every cell instead of random pick. This method of continues cell exploring efficiently finds all the traceries in high dimensional area. Preplanning and re-planning initiates rescue robot to check the feasibility of path in the desired area. The improved path planning with REB mechanism is implemented first in simulations and after in physical rescue robots. Robot with REB mechanisms always step forward to its target even in dynamic and challenging domains. The path generated by REB also more efficient compared to previous paths obtained by normal path planning algorithms. The REB simulation is implemented in JVM Java Virtual Machine.***

Keywords: Rescue robot, rival, REB, collision free JVM

1. Introduction

In our planetary path planning during disaster is very complex in some uncertain conditions like wrong guessing of path, detection of untargeted block and time management. The existing path planning mechanisms works on the higher probability guessing.

The study of existing work is categorized in to following stages:

Stage 1 Path planning in known strategy, which always tracks the path in the known environment. The robot in the unknown area fails to detect the original path of the target leads to failure of selecting the feasible path.

Stage 2 Random Path selection also faces problems by choosing the wrong path, the probability of guessing fails in some condition of exploring the untargeted blocks.

Stage 3 Guessing of wrong target, some robots in rival areas detect the target in the wrong assumption.

The appearance and the behavior of rival target makes robot for wrong guess. The existing algorithms also works to find the known obstacle in the planned area, it does not guides to detect the new obstacles in the current location. The problems can be deduced by the implementation of REB mechanism. Rapidly Exploring Mechanism allows robot to explore each and every blocks in the target area in the by rapidly increasing the exploring time.

It avoids the wrong guessing. The implementation of preplanning and re-planning process guides rescue robot to planning the accurate collision free path in the rescue field. Preplanning directs rescue robot to origin its initial path n target area with preplanned path plan, by this the rescue robot knows its path in their environment. Re-planning directs rescue robot to re-plan the path from its original path n case of detection of new unknown obstacles, it makes robot to divert its path from the tangential line.

2. REB Configuration and Navigation

The rescue robot is configured with REB to moves in a 3 dimensional environment in different obstacles levels. The probability guessing is neglected for the projection for rapid explore. The detection and explore is efficiently oriented with event grids of dynamic cells. The movement of robot is specialized by entire 360º in the target area. The movement action is;

R= {Forward, Turn-Left, Turn-right, Turn-around Backward}…… (1)

The actions are controlled by robotic mechanism, the mechanism instructs to explore the next available cell in the block, it allows robot to move in different directions and the path selection also depends on the explored blocks. REB allows robot to explore all the blocks it makes collision free path. The robot has free navigation in the space by the configuration of REB. Nearest block in from the current position is explored first for time savings and it allows robot to navigate in all environment.

- Directs rescue robot to move one step forward from the current position.
- Define zigzag by turn-left and turn-right. It always explore all blocks
- Always takes new block for explore by Turn-Around. Does not waste its time by detect explored blocks.
- Backward makes robot to come back in alternate path. The return path always differs from origin path.

These functions partite the configuration worlds into known and unknown world by its understanding feature. The feature differs from robot's use and emergency. In known environment the blocks are explored manually by the robot action but in unknown environment virtual assumption is introduced to explore the blocked cells. The virtual assumption depends on the re-planning path. The robot have the choice to move in the both the environment. The obstacles may be present in the any blocks so it has no choices in path. The movement is also fixed so it can have only one action at time. The path planning and REB is executed rapidly in each steps until it reach its final destination. The target may be present in any of the blocks at the same time obstacles also present in the unexplored blocks. In these criteria guessing fails to define the destination. Configure REB is the best way to navigate in all environments

3. REB Mechanism

The objective of this mechanism is to allows robot detect the specified target in the rival environment. It allows rescue robot to explore every cell (i.e.) in real world to search the target in all places instead of guessing palaces. The guessing may be occurs wrong in some situation it leads to failure in saving the humans from harm. At the ultimate stage by exploring the target problems in the path planning also terminate by introduce the new method of path planning algorithms.

3.1 REB Planning

An REB detects for the path from the starting stage to target stage by exploring the all blocks in the simulated environment. Three main functions are required for this explore.

The 3 primitives are EXPAND, EXPLORE and ENTRY.

- Function EXPANDS (from world current: target)
- Function EXPLORES (each cell: current: around: destination)
- Function ENTRY (explored cell current: target)

Finally the entry function finds the new location for the movement of robot in the unknown world. Explore function helps to detect the both obstacles and target and makes the robot to move around in obstacle free and collision free environment. The REB then expand the path by using the expand function.

4. Path Planning

Path planning always based on the both known and unknown environment. In known environment the blocks are automatically get explored by the sense of robotic movements and in unknown environment the blocks are get explored after the robot's movement. For both the environment the path planning will be differed as preplanning and as re-planning.

4.1 Path planning Mechanism

The mechanism implements preplanning and re-planning algorithms for known and unknown world. The world changed its nature often to known to unknown depends on the behavior of the rescue robot.

4.2 REB Algorithm

Function ERB Plan (beginning stage:goal:target stage);

Var expand,explore,entry;

Var node:erb node;

Nearest: =initial;

erb node: =initial;

while(Distance(initial,goal)<threshold)

target=choose target(Explore);

nearest=Nearest(node,target):entry;

expand=Expand (env,nearest node,target node);

if expand !=Empty Stae then

NextNode (node,explored);

Return node;

Function entry (goal:state):state

Var block:erb block;

If 0<block<target then

Return goal;

else if target <block<1 then

return initialstate()

Preplanning: The preplanning module is used to route robot path from the starting point to destination point. The change from one coordinate location to another location is determined as best path from where the robot is currently located.

Re-planning: The Re-planning module is used to route alternate path from the destination point to starting point. The change in the desired path is re-planned due to the obstacles in the routing path.

4.3 Instructions

1. Robot Location: The starting coordinate (x, y) is determined to find where the robot s currently located from the starting point.
2. Target: To specify the destination location of (x, y).
3. Preplan: To specify the current available path
4. Short Distance: To specify how the target is close to the robot and remove the unwanted target distance from the wavelength
5. Re-plan: To reset the path to non-visited blocks from the starting coordinate(x, y) n the planner.
6. Path: To specify the available path from the non visited blocks.
7. Shortest path: It is the optional to manage the time in the emergency time.
8. Explore: Makes robot to automatically explore the blocks from the starting stage to target stage.

5. Implementation and Simulation Results

The work has been developed by the implementation of REB algorithm. The obstacle block is mentioned in red and target is in green color and the explored path in blue. The coordinate values are corresponding to the belief map.

Belief Map refers to the manual assumption of coordinate values. The motion control is for re-plan, the manual setting of path from the normal path due to the presence of obstacles in the actual path.

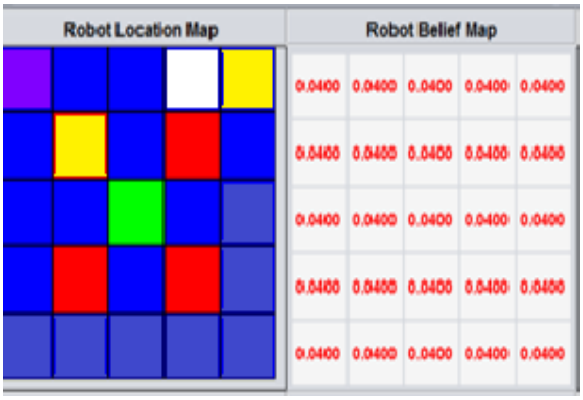

Figure 1: REB mechanism at initial stage

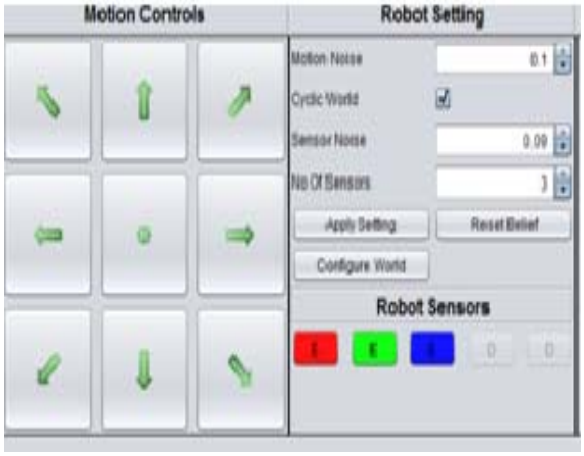

Figure 2: Re-plan path control

The simulation output will be for both preplan and re-plan implementation. The actual path is mentioned in blue and alternate path is mentioned in purple. The alternate path is automatically obtained once it finds.

Figure 3: Exploring blocks after re-plan

6. Conclusion

In this work robot motion control system is developed by the implementation of REB mechanism. It terms as high performance path planner on the basis of preplan and re-plan. The simulation result shows the real robot will able to perform better than previous plan. This is the first application work of REB approach. The exploring time is increased by the basis of environment. The block is explored by the robot movement in preplan and in re-plan the robot explores the block in forward step. This work concluded up the system is simple and best and expect as common adaptive system for upcoming path planner in future.

7. Future Work

In this work REB implemented only for rescue robot. In future extended ERB is initiated in commercial physical robots.

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