# Laser simulator: A novel search graph-based path planning approach

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**ABSTRACT**
A novel technique called laser simulator approach for visibility search graph-based path planning has been developed in this article to determine the optimum collision-free path in unknown environment. With such approach, it is possible to apply constraints on the mobile robot trajectory while navigating in complex terrains such as in factories and road environments, as the first work of its kind. The main advantage of this approach is the ability to be used for both global/local path planning in the presence of constraints and obstacles in unknown environments. The principle of the laser simulator approach with all possibilities and cases that could emerge during path planning is explained to determine the path from initial to destination positions in a two-dimensional map. In addition, a comparative study on the laser simulator approach, A* algorithm, *Voronoi* diagram with fast marching and *PointBug* algorithms was performed to show the benefits and drawbacks of the proposed approach. A case study on the utilization of the laser simulator in both global and local path planning has been applied in a road roundabout setting which is regarded as a complex environment for robot path planning. In global path planning, the path is generated within a grid map of the roundabout environment to select the path according to the respective road rules. It is also used to recognize the real roundabout from a sequence of images during local path planning in the real-world system. Results show that the performance of the proposed laser simulator approach in both global and local environments is achieved with low computational and path costs, in which the optimum path from the selected start position to the goal point is tracked accordingly in the presence of the obstacles.

**KEYWORDS:**
Laser simulator (LS); local and global path planning; local map; roundabout; A* algorithm (A*A)