Path Planning for Orchard Robot Using Occupancy Grid Map in 2D Environment

Authors : Satyam Raikwar, Thomas Herlitzius, Jens Fehrmann

Abstract : In recent years, the autonomous navigation of orchard and field robots is an emerging technology of the mobile robotics in agriculture. One of the core aspects of autonomous navigation builds upon path planning, which is still a crucial issue. Generally, for simple representation, the path planning for a mobile robot is performed in a two-dimensional space, which creates a path between the start and goal point. This paper presents the automatic path planning approach for robots used in orchards and vineyards using occupancy grid maps with field consideration. The orchards and vineyards are usually structured environment and their topology is assumed to be constant over time; therefore, in this approach, an RGB image of a field is used as a working environment. These images undergone different image processing operations and then discretized into two-dimensional grid matrices. The individual grid or cell of these grid matrices represents the occupancy of the space, whether it is free or occupied. The grid matrix represents the robot workspace for motion and path planning. After the grid matrix is described, a probabilistic roadmap (PRM) path algorithm is used to create the obstacle-free path over these occupancy grids. The path created by this method was successfully verified in the test area. Furthermore, this approach is used in the navigation of the orchard robot.