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Fast Return Path Planning for Agricultural Autonomous Terrestrial Robot in a Known Field

Authors : Carlo Cernicchiaro, Pedro D. Gaspar, Martim L. Aguiar

Abstract : The agricultural sector is becoming more critical than ever in view of the expected overpopulation of the Earth. The introduction of robotic solutions in this field is an increasingly researched topic to make the most of the Earth's resources, thus going to avoid the problems of wear and tear of the human body due to the harsh agricultural work, and open the possibility of a constant careful processing 24 hours a day. This project is realized for a terrestrial autonomous robot aimed to navigate in an orchard collecting fallen peaches below the trees. When it receives the signal indicating the low battery, it has to return to the docking station where it will replace its battery and then return to the last work point and resume its routine. Considering a preset path in orchards with tree rows with variable length by which the robot goes iteratively using the algorithm D*. In case of low battery, the D* algorithm is still used to determine the fastest return path to the docking station as well as to come back from the docking station to the last work point. MATLAB simulations were performed to analyze the flexibility and adaptability of the developed algorithm. The simulation results show an enormous potential for adaptability, particularly in view of the irregularity of orchard field, since it is not flat and undergoes modifications over time from fallen branch as well as from other obstacles and constraints. The D* algorithm determines the best route in spite of the irregularity of the terrain. Moreover, in this work, it will be shown a possible solution to improve the initial points tracking and reduce time between movements.

Keywords : path planning, fastest return path, agricultural autonomous terrestrial robot, docking station
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