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Optimal path planning of a disinfection mobile robot against COVID-19 in a ROS-based research platform

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ABSTRACT

Due to COVID-19 pandemic, there is an increasing demand for mobile robots to substitute human in disinfection tasks. New generations of disinfection robots could be developed to navigate in high-risk, high-touch areas. Public spaces, such as airports, schools, malls, hospitals, workplaces and factories could benefit from robotic disinfection in terms of task accuracy, cost, and execution time. The aim of this work is to integrate and analyse the performance of Particle Swarm Optimization (PSO) algorithm, as global path planner, coupled with Dynamic Window Approach (DWA) for reactive collision avoidance using a ROS-based software prototyping tool. This paper introduces our solution – a SLAM (Simultaneous Localization and Mapping) and optimal path planning-based approach for performing autonomous indoor disinfection work. This ROS-based solution could be easily transferred to different hardware platforms to substitute human to conduct disinfection work in different real contaminated environments.

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Izvirni znanstveni članek

Optimalno načrtovanje poti mobilnega robota za dezinfekcijo proti COVID-19 v raziskovalnem okolju, ki temelji na ROS

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POVZETEK

Zaradi pandemije COVID-19 je vse več povpraševanja po mobilnih robotih, ki bi nadomestili človeka pri nalogah razkuževanja. Nove generacije dezinfekcijskih robotov bi lahko razvili za navigacijo v območjih z visokim tveganjem in izpostavljenosti pogostim dotikom. Javni prostori, kot so letališča, šole, nakupovalna središča, bolnišnice, delovna mesta in tovarne, bi lahko imeli koristi od robotske dezinfekcije v smislu natančnosti opravljenih nalog, stroškov in časa izvedbe. Namen tega dela je integrirati in analizirati delovanje algoritma za optimizacijo z rojem delcev (PSO) za globalno načrtovanje poti, s pristopom dinamičnega okna (DWA) za reaktivno izogibanje trkom, z uporabo orodja za izdelavo prototipne programske opreme, ki temelji na ROS. Ta članek predstavlja našo rešitev – SLAM (sočasna lokalizacija in preslikava), ki temelji na načrtovanju optimalne poti za izvajanje avtonomne dezinfekcije v zaprtih prostorih. Rešitev, ki temelji na ROS, bi bilo mogoče zlahka prenesti na različne platforme strojne opreme, da bi nadomestili človeka za izvajanje dezinfekcijskih nalog v različnih onesnaženih okoljih.

PODATKI O ČLANKU

Ključne besede:
Dezinfekcijski mobilni robot;
COVID-19;
Načrtovanje optimalne poti;
Optimizacija z rojem delcev (PSO);
Sočasna lokalizacija in preslikava (SLAM);
Pristop dinamičnega okna (DWA);
Robotski operacijski sistem (ROS);
Platforma, ki temelji na ROS

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