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Expanding the perceptual area of a vision/depth sensor using a rotating platform for applications in multi-robot systems

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Abstract (300 word limit)

The authors have designed one degree of freedom rotating platform with an Intel RealSense camera on it. The rotating platform will be mounted on a mobile robot. The rotating platform will help a follower robot (figure 1) track an ArUco marker on the leader robot and measure its pose. One of the main aims is to minimize the error from the ArUco marker detection method and combine the feature of a depth camera for distance detection. In this research extended Kalman filter be used to merge two inputs of distance measurement first from the ArUco detection method and the second from the depth measurement. The mechanical design of the rotating platform has less vibration due to its design and it is easy to manufacture by 3D printer. The experimental data of distances from the ArUco detection and depth measurement was collected by moving the rotating platform at different speeds and by placing the ArUco marker at different distances. After the data collection, 3D plots of distances from both the distance detection methods were generated in MATLAB. The conclusion of this research will be helpful to the researchers and developers to reduce the error from ArUco detection with data convergence from the depth sensor and gives a good way to follow the leader-follower robot configuration.

Image



Figure 1. Follower robot with rotating platform.

Recent Publications (minimum 5)

1. Joon A, Kowalczyk W (2021) Design of Autonomous Mobile Robot for Cleaning in the Environment with Obstacles. Applied Sciences. 11(17):8076. https://doi.org/10.3390/app11178076.
2. Kowalczyk W (2019) Formation Control and Distributed Goal Assignment for Multi-Agent Non-Holonomic Systems. Applied Sciences. 9(7):1311. https://doi.org/10.3390/app9071311
3. Kowalczyk W, Kozłowski K (2019) Trajectory tracking and collision avoidance for the formation of two-wheeled mobile robots. Bulletin of the Polish Academy of Sciences: Technical Sciences. 10.24425/bpas.2019.128652
4. Przybyła M, Kowalczyk W, Kozłowski K (2017) Navigation Function Used for Parallel Parking in Restricted Area by a Differentially-Driven Mobile Robot. IFAC-PapersOnLine. https://doi.org/10.1016/j.ifacol.2017.08.852
5. Kowalczyk W, Przybyla M, Kozlowski K (2017) Set-point Control of Mobile Robot with Obstacle Detection and Avoidance Using Navigation Function - Experimental Verification. J Intell Robot Syst 85, 539–552 (2017). https://doi.org/10.1007/s10846-016-0388-2

Photograph



Biography (150 word limit) - Author 1

Arpit Joon is currently pursuing a Ph.D. at Poznan university of technology, Poland. His research topic is "Control algorithm for a team of autonomous mobile robots." which comes under multi-agent systems. His interest focuses on 3D printing, designing mechanical parts of robots, control of robots, robot operating system (ROS), and python programming language. He completed his Master of Science degree (M.sc) in Automatic control and robotics from Poznan university of technology in 2021. In 2019, he completed his degree bachelor of technology (B.Tech) in Mechanical engineering from SRM University, India. In his B.Tech he mainly focused on Fused deposition Modelling (FDM) 3D printing which included designing hardware and making control algorithms for machines.

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Photograph



Biography (150 word limit) - Author 2

Wojciech Kowalczyk received the M.Sc. degree in robotics from Poznan University of Technology (PUT), Poland in 1998. In 1999-2000 he was working as electronics design engineer and software developer (programming databases and communication applications for retail chains). Since 2000 he works at Poznan University of Technology where he received the Ph.D. degree in robotics in 2008. In 2019 he received a habilitation degree. His scientific interests focus on the multi-agent systems, mainly on their application in the control of multiple mobile robots, collision avoidance and cooperative behaviours of non-holonomic robots at both kinematics and dynamics level. He conducts theoretical studies and research on practical applications. He participated in mobile robotics projects at PUT. He was also involved in medical research projects including control system assisting surgeon in laparoscopy and development of the device supporting rehabilitation of the lower limb. He teaches multi-agent systems, smart systems, robotics, object-oriented programming, and computer sciences in robotics.

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Notes/Comments: