

Introduction and motivation

Traditional mobile platforms (like car's) are mostly built on a four-wheeled base with two steerable wheels. This type of platform limits the feasible motions. Moving sideways and turning around are problematical maneuvers for conventional mobile platforms. The construction of special kinds of wheels, which enables the platform to move in any desired direction (omnidirectional), is a suitable solution to resolve these disadvantages.

Mecanum wheels

This kind of omnidirectional wheels was invented in 1973 by the Swedish inventor Bengt Ilon. He first formulated and patented the idea of a wheel, which has additional rubber rollers attached at the circumference of a "normal" wheel (like it is depicted in fig. 1).



Fig 1. 3D rendering of an omnidirectional wheel

Mechanical construction

The concept of this platform differs from existing rectangular-shaped ones by a novel, octagonal base-form construction. The kinematic properties of the platform are not limited due to this way of construction at all. On contrary it is possible to achieve remarkable benefits in combination with the robot operating system ROS (autonomous navigation).

System architecture

The heart of the robot is an RTAI Linux based PC system, which controls the four motors. These motors are connected via the CAN bus based CANopen protocol. The reference velocities are transferred to the motor control units where an internal trajectory generator and controller processes them. Therefore, the used control concept of the whole robot has a decentralized setup.

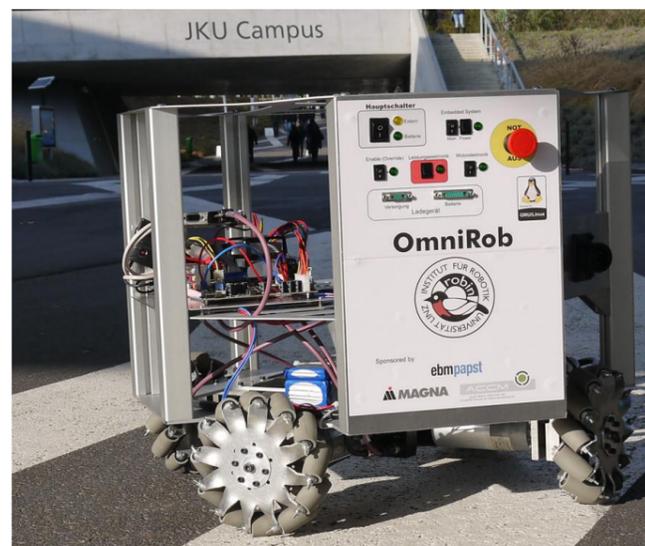


Fig 2. The final, omnidirectional mobile robot

The architecture of the used software is shown in fig. 3. The developed CANopenServer implements the missing link between Matlab/Simulink and the CANopen based bus system.

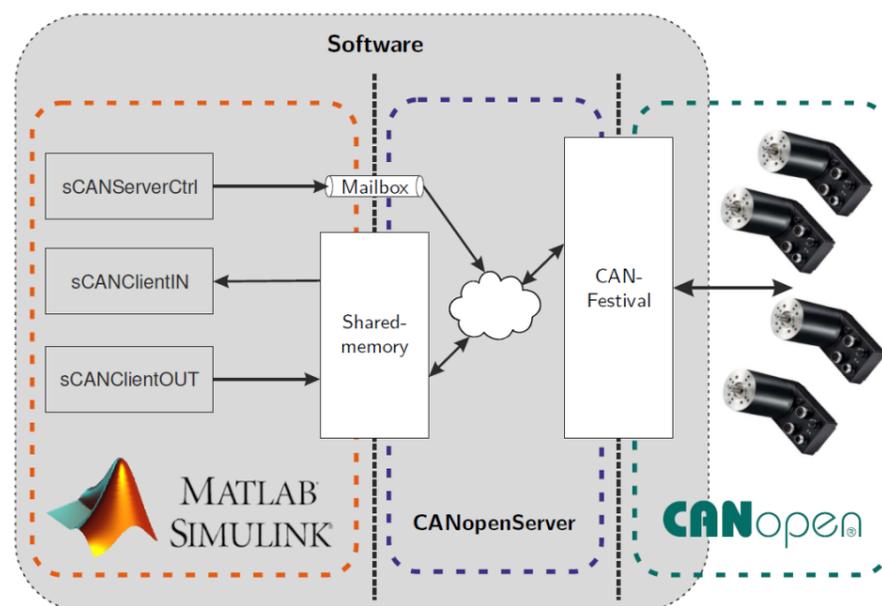


Fig 3. Interface between Matlab/Simulink and CANopen

Technical data

The platform has a total width of 765mm, a total height of 585mm and is driven by four ebm-papst motors with 270W each. An LiPo accu pack with a nominal voltage of 25.9V and 16Ah of capacity powers the system.

References

- (1) M. Wildbolz. "Aufbau, Modellierung und Regelung eines mobilen Roboters mit omnidirektionalen Rädern", Johannes Kepler University Linz, Master Thesis, 2012.
- (2) P. Muir and C. Neuman. "Kinematic modeling for feedback control of an omnidirectional wheeled mobile robot", Proceedings of IEEE International Conference on Robotics and Automation, 1987.