

Competition Title: Advanced mobile cooperative robot technology

Industrial Applications ■Intelligent Manufacturing □Intelligent Driving □Intelligent Life □Smart Medicine □Smart City

Background description

[Overall background]

Under the influence of the aging of the population, the increase of labor cost, the return of the manufacturing industry in the developed countries and the low price competition in the Southeast Asian countries, China's manufacturing industry is in urgent need of transformation and upgrading. Therefore, the 2025 strategic plan of manufacturing in China is introduced, and the robot will be the core equipment for realizing intelligent manufacturing. Although cooperative robots are more flexible than traditional industrial robots, they still have many limitations. The most important point is that cooperative robots are generally fixed near designated workstations, so they can only accomplish specific tasks at specific locations.

[Business background]

If cooperative robots can be moved, the above problems will be solved. A small number of robots can quickly reach different workstations and perform different tasks. Meanwhile, the operator can control a large number of robots at the same time in the remote operating room, while getting higher throughput and higher precision.

Project description

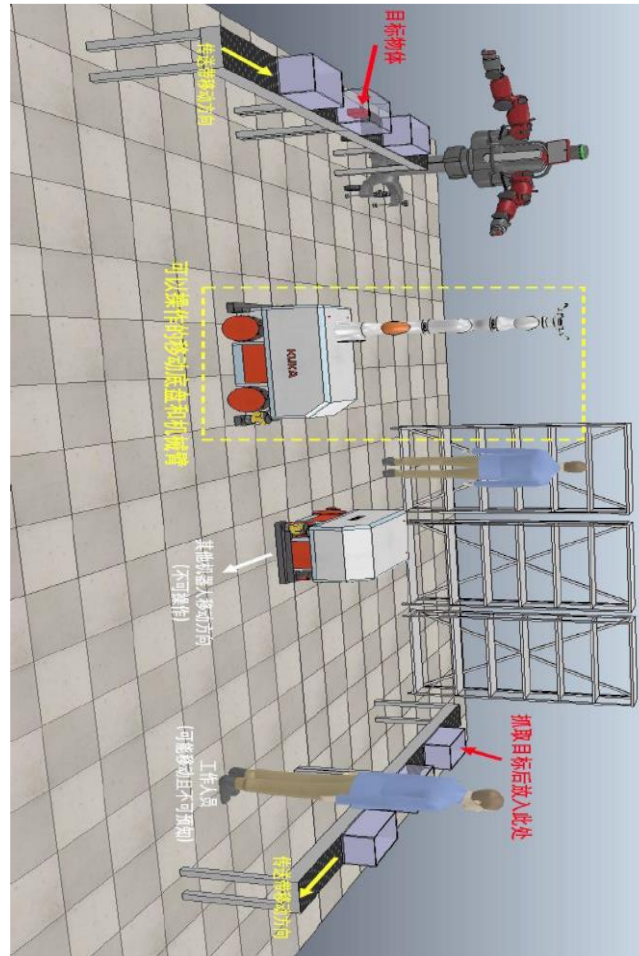
[Problem description]

Although there are some examples of the AGV, the current application is usually to move the AGV first and then manipulate the manipulator, which is very inefficient and cannot perform all the performance of the AGV and the manipulator. The overall production efficiency will be greatly improved if the AGV and the manipulator can be implemented in collaboration with the AGV and the manipulator.

[User expectations]

In a similar storage or industrial environment, a fast crawling task is implemented with AGV and a manipulator platform, as shown in the following figure

(<https://pan.baidu.com/s/1jow-FuZCsX7hzAwA3TqZgg>):



(2) The whole process should be very efficient, such as the whole process of the chassis, and the whole process must ensure that there is no collision with other objects (equipment, other robots, employees).

(3) We do not require the accuracy of the chassis and the manipulator, but to achieve the above expectation, the accuracy of the chassis and manipulator should be at the millimeter level.

[Expected economic effect]

The market for cooperative robots is huge and is still rising rapidly. China is a big manufacturing country in the world. There are more than 400 thousand industrial enterprises above designated size. Among them, there are more than 48000 enterprises in Jiangsu alone, ranking first in the country. These enterprises urgently need more efficient automation solutions. The boom in robotics is not just happening in China. The global cooperative robot market in 2025 will reach nearly 800 billion Yuan.

The implementation of this scheme will not only bring huge technical and economic benefits to the related robotic company, but more importantly, it will make a qualitative leap in the manufacturing level of China / Jiangsu.

Task requirements

[Technical path]

(1) Based on Robot Operating System (ROS).

(2) Location and navigation can be achieved using radar or visual technology, and AR code can be used to locate target objects to be captured.

(3) Different grasping tools can be used, such as sucker or manipulator.

(4) The picture in the project description is just an example. The player can choose different mobile robots and scenes according to their actual situation, but the following points should be ensured:

a) the distance between two conveyer belts is greater than 3 meters, and at least two obstacles between them; b) the conveyor belt moves at a constant speed and is more than equal to 0.1 meters per second; c) the box / container depth of the target object is not less than 30cm; d) allows additional sensors (cameras, lasers) to be added anywhere in the scene. Radar, motion capture equipment, etc. are used to monitor the movement of objects, obstacles and other robots.

#### [Technical indicators]

(1) Fastest speed to complete the task, the whole process of mobile chassis average speed of not less than 0.2m/s, chassis cannot stop more than 2 seconds.

(2) Robot can not collide with any other device, robot or human in the whole process.

#### [Standard submission]

Referring to the legend given in the technical indicators, the participants design a specific simulation environment and develop it to achieve the specified technical specifications. Gazebo, VREP and other simulation software can be selected.

#### [Task list]

(1) Simulation video display

(2) Source code packages that can be run under ROS

(3) Solid robot experiment display (non compulsory as bonus item)

#### Reference information

##### [Reference tool]

ROS <http://www.ros.org/>

MoveIt <http://moveit.ros.org/>

Gazebo <http://www.gazebosim.org/>

VREP <http://www.coppeliarobotics.com/>

##### [Reference data]

(1) several related mobile chassis plus robotic platform:

A) KUKA KMR iiwa,

<https://www.kuka.com/en-de/products/mobility/mob>

B) SIASUN composite robot,

[http://www.siasun.com/index.php? M=content&c=index&a=Show&catid=24&id=243](http://www.siasun.com/index.php?M=content&c=index&a=Show&catid=24&id=243)

C) big family Star robot,

[Www.hansrobot.com/prod\\_view.aspx? TypeId=10&Id=177](http://www.hansrobot.com/prod_view.aspx?TypeId=10&Id=177)

(2) analog display of similar functions:

<https://pan.baidu.com/s/1HZ2CqF9TkpcWAqkzCj2fDg>

[Data interface]

It is based on ROS and accords with ROS related data structure and communication standard.