Integration of Robotical Arm and Vision System with Processing Software using TCP/IP Protocol in Industrial Sorting Application

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Abstract. The efficient flow of products on production lines has great importance for every producer. Considering the short life cycle of products, the performance of the production line determines the production efficiency. The problem is particularly visible on product sorting (picking) lines. In this article, the authors presented the problem of sorting products using the KINOVA robot equipped with vision system. The issue involves the integration of the robot with the vision system and their configuration. The Adaptive Vision Studio software is employed for the image recognition taken with an ordinary camera. Depending on the data received from the camera, the robotic arm is ordered to move to a specific predefined location. This is used in an industrial environment where the robotic arm is required to pick up the objects based on the QR code labelled on each item.

INTRODUCTION

The replacement of specialist equipment and people with robots is particularly important in the context of producer competition, which forces endless changes in the shape and properties of products and packages. This is visible, for example, in the food industry, where production is very demanding and currently often automated.

Due to the diversity of production processes, the speed of products production, their number and dimensions, it is necessary to choose robots for a specific application. Among the basic factors to consider sorting applications are: loads and ranges of robots, the number of freedom degrees of the robot, number of production cycles, repeatability and working environment. The first two factors are directly related to the products. Their weight and weight of gripper together indicate the required lifting capacity of the robot (20% of the mass margin is often used). Sorting applications are also related to the repeatability of the robot - for example, the high repeatability of the sorting (picking) robot ensures a better placement of the products in the containers. A large number of work cycles ensure smooth product flow and high productivity. Constantly increasing production requirements are a challenge for engineers.

In this work, the problem of controlling the Kinova arm using image recognition is tackled. The Adaptive software is used for the image recognition. This software is installed on the computer along with the Kinova application. Using the TCP/IP protocol, the two applications are connected and the data from the Adaptive Vision software is communicated to the Kinova arm to trigger the arm movement.

In this paper, the aim of the authors is to present an integration of a vision sensor with the robotic arm in Windows environment using existing libraries in product sorting applications. The result of this project is a robot integration with a vision controlled environment. The Robotic arm will pick up the object recognized by the software vision system based on the QR code. Each of the objects are registered in the database along with their corresponding QR code.

FIGURE 2. Workbench: Kinova robotic arm and Laptop PC with Machine Vision Software

HARDWARE INTEGRATION

For this project three devices, are connected together by different interface type. The Kinova Mico arm actor, is connected by Universal Serial Bus to the Windows Based Laptop PC. The Camera sensor is connected to the computer by Ethernet network using WiFi router.
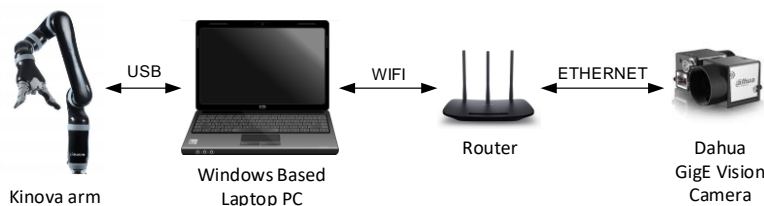
FIGURE 1. Block diagram

CONCLUSION

In this paper, the integration of the robotic arm Kinova with a vision system was studied. The latter consists of an ordinary GigE Vision camera combined with the Adaptive Vision System software installed on the computer. They both allow recognizing images and reading the QR code labeled on an object for instance. The resulted data from the image processing is used for controlling the Kinova arm. This application could be used in an industrial chain where the robotic arm is required to pick up the items based on the QR code labelled on the object.

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