Development of a Robot Setup Tool "SANMOTION C"

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1. Introduction

The main aim of the "SANMOTION C" motion controller is to control servo systems. It is a controller product which combines PLC (sequence controller), motion controller and robot controller functions all in one. This controller can support a variety of applications, however in particular its ability to develop robot systems will be useful in Asian markets where automation is desired for the future.

A teaching operator is used to teach industrial robots, however in order to reduce the time taken to perform this task on-site, there is a demand for a method enabling robots to be programmed easily from a computer. In response to this demand, Sanyo Denki has developed a robot setup tool which allows the processes conventionally developed by teaching operators to be performed simply on a computer. At the same time as this development, improvements were also made to the conventional system development tool.

This paper presents an overview of the developed product.

2. Background of the Development

In robot system development using the conventional "SANMOTION C", a teaching operator was provided to teach robots and even in programing, the user was required to perform tasks on the operator screen. However, there are more opportunities to give robots complicated movements, and accordingly programs have become complicated, meaning more time is required on the operator to complete tasks. Moreover, the type of robot mechanisms are increasing for the respective applications and the types of motors used in the axes are diversifying.

As a solution to these kinds of issues, we made improvements to the conventional system development tool (STUDIO-RC) and developed a robot setup tool to enable users to develop robot systems easier.

3. Overview of the Robot Setup Tool

3.1 Programming function

Fig. 1 shows the programming screen of the robot setup tool. The structure of the projects and programs for robot programming are displayed on the left, while the details of programs are displayed on the right. Programs can be edited, saved, compiled, uploaded and downloaded, and any programs created can be immediately executed.

Moreover, regarding debugging of programs, adjustments can be made while confirming the robot's orientation in either single steps of the program or continuous execution.

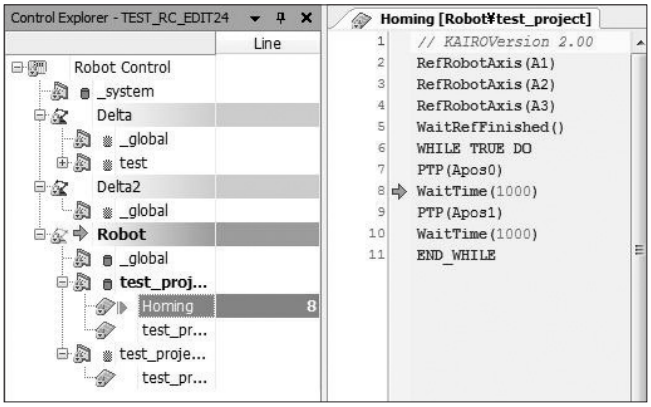

Fig. 1: Programming screen

We have also prepared various types of robot program commands which can be used to suit the actual application.

Table 1 shows the main command types.

Table 1: Main command types

Command name	Description
PTP	Point-to-point travel
LIN	Linear interpolation travel
CIRC	Circular travel
PTPRel	Specified distance PTP motion
LINRel	Specified distance linear interpolation motion
StopRobot	Stops robot
WaitFinished	Waiting for processing of robot commands
RefRobotAxis	Origin recovery
TOOL	Tool coordinates settings
Ovl	Overlap setting (Path)
Ramp	Acceleration curve setting
WaitTime	Waiting for time to pass (timer)
DIN.Wait	Waiting for digital input
Dout. Set	Digital output setting (BOOL)
WHILE ... DO	Loop control
IF ...THEN	Branch command

The development of this robot setup tool reduces development time by enabling customers to edit and debug robot programs on a computer as an alternative to the teaching operator.

3.2 CAD import function

Fig. 2 shows the screen of the CAD import function. The CAD import function of the robot setup tool supports DXF and Step format CAD data, and robot programs can be created automatically by importing this data.

This has increased the efficiency of robot development, as previously it was extremely difficult to create programs which involved moving robots along complex-shaped trajectories.

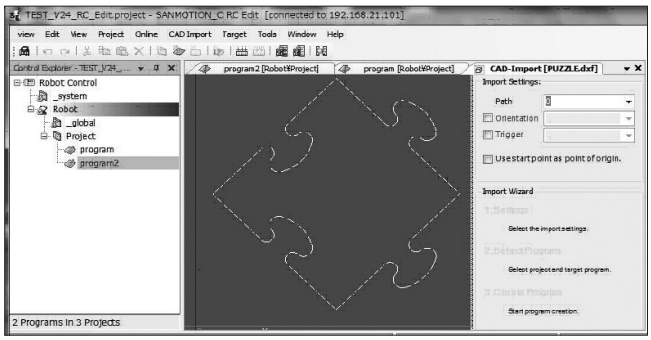

Fig. 2: CAD import function screen

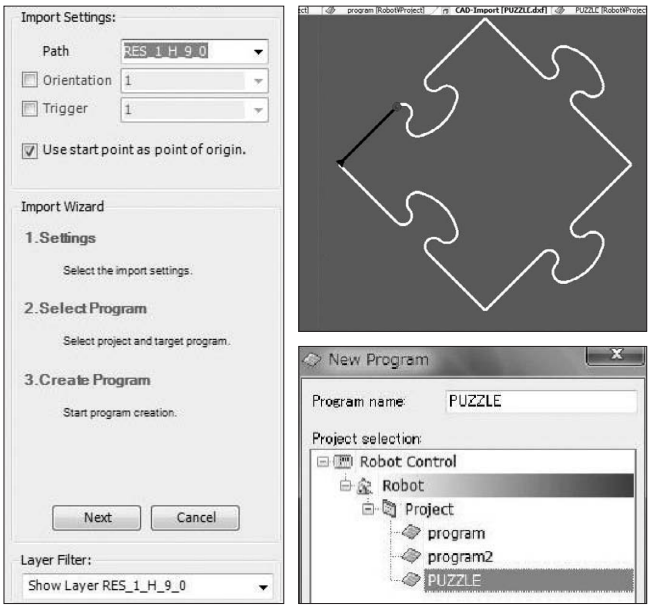

Fig. 3: CAD import steps

Fig. 3 shows the related input steps. An import wizard has been prepared to specify robot motion trajectory with CAD data and by following the steps, the geometry travel start position and end position can be specified. Moreover, by specifying the timing of an interrupt motion timing referred to as “trigger point”, it is possible to perform a program interrupt motion during travel.

For example, it is easy to add an interrupt motion during the robot machining motion to switch the jig held by the robot smoothly. Once all of the robot motion trajectories are specified using a CAD drawing by the specification steps of the import wizard, a program will be automatically generated.

Fig. 4 shows the screen of the generated program.

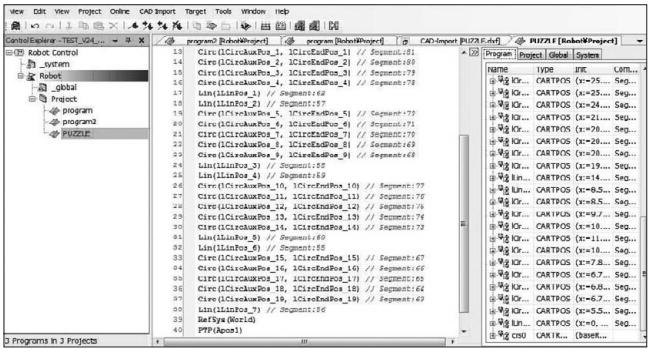

Fig. 4: Generated program screen

4. Expansion of the System Development Tool (STUDIO-RC)

Improvements were made to the system development tool (STUDIO-RC) in order to effectively utilize the robot setup tool.

4.1 Multiaxis amp setting function supporting EtherCAT

EtherCAT, adopted by SANMOTION C as a network for communication with the servo amp, is supported by many equipment manufacturers due to its openness, high-speed and safety as an industrial network. We have added a function to enable the configuration of multiaxis amps using this network. Fig. 5 shows a configuration screen for a SANMOTION Model No. PB 2-axes Integrated Driver with Built-in EtherCAT Interface.

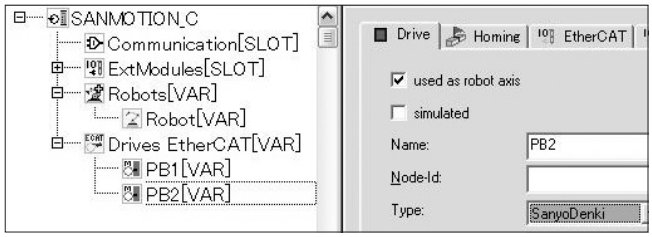

Fig. 5: Multiaxis amp configuration screen

4.2 Image processing system interface

A demand arose to link image processing systems with robots, therefore we prepared a software library to communicate with an Ethernet-based image processing system and made setup easy. Fig. 6 shows the configuration screen of the image processing system.

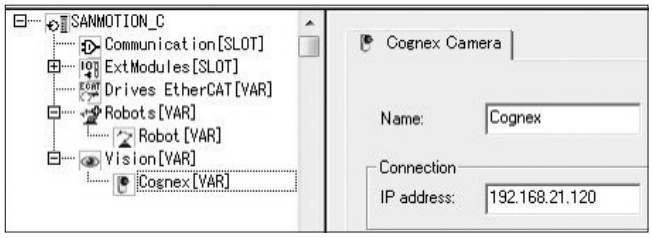

Fig. 6: Configuration screen of the image processing system

4.3 Addition of robot kinematics

SANMOTION C has a kinematics database enabling it to control over 10 robot types, however in this improvement activity, we added kinematics for palletized robots and robots with 2-axes link mechanism due to a strong demand from our customers.

Supporting these robot types makes it possible to easily develop systems using robots with the main purpose of palletizing and conveyance. Fig. 7 shows the configuration screens of the newly added robot types

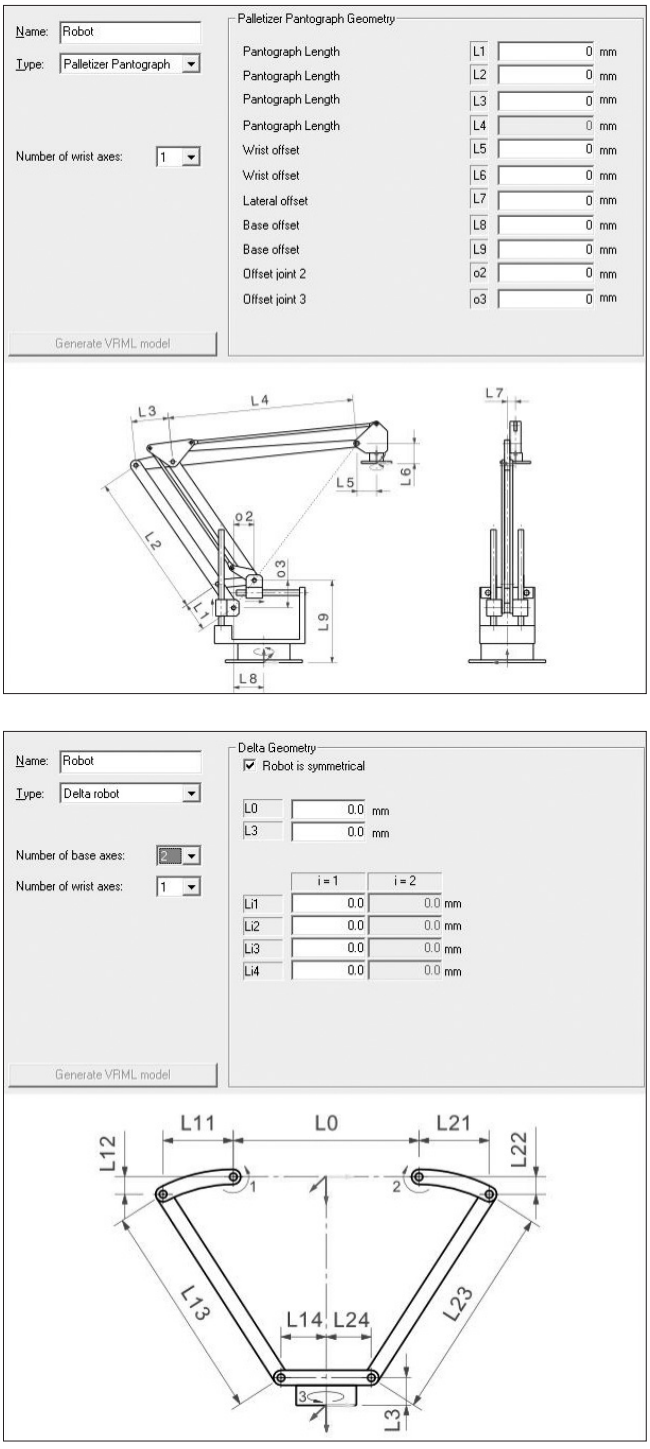

Fig. 7: Robot type configuration screens

5. Conclusion

The addition of the “Robot Setup Tool” to the “SANMOTION C” motion controller has made it possible to propose system development to customers with even higher efficiency than before. Moreover, the improvement of various functions such as image processing systems and SANMOTION Model No. PB 2-axes Integrated Driver with Built-in EtherCAT Interface has made it possible to propose new systems to existing customers which use motion and robot control functions, therefore new business is highly anticipated.

Meanwhile, it must not be forgotten that it is not important for customers which controller or development tool they use, as for them these are merely means to an end. We wish to develop products which play major roles around the world with due consideration to product development means and what customers really expect of us.

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