Open Embedded Architecture Robotic Controller for Position and Force Control

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***Abstract* - Generally the robotic controllers are developed for position control, without accomplishing integrally the requirements of tasks in which interactions with the environment occur. However, this is currently one of the main research areas in robotics. To consider this interaction the robot controller has to give priority to the force control time response, because in the instant of end-effectors contact with the surface, several forces act on them which lead to damages. To avoid this proposed work design embedded system for position as well as force control to improve efficiency. Embedded implies integration of various functional blocks on one System-On-Chip board, for data acquisition, computation and control tasks, of relatively small size and low power consumption, compared to regular PC-based industrial controllers. It is industrial robot type independent, as long as the motors are equipped with incremental position encoders and driven by PWM signals.This is done with at Mega128 microcontroller which is communicated through Pcs.**

1. INTRODUCTION

The objective of the proposed work will be to control the position and force of robotic arm in working environment to reduce the possible damages or errors to the environment in contact and diminishes the necessity of compliance in system. Current robotic applications are limited by the industry state of art of the manipulators control algorithms. The inclusion of force and vision feedbacks, the possibility of cooperation between two or more manipulators, the control of robots with irregular topology will certainly enlarge the industrial robotics applications. The development of control algorithms to this end brings the necessity of the use of controllers with open architecture. As a matter of fact, rapid prototyping, i.e., the capability of designing and testing new control algorithms in short time and with limited costs, is becoming a fundamental issue in industrial robotic applications. Notice that the degree of openness. In a robot controller may vary from one system to the other. Usually the control of some components of the system (e.g., the power system, the low level control) are proprietary and cannot be modified by the user, others may be considered open (e.g., the communication interface, the higher level control), i.e., are based on standard hardware and software with open interface specifications.

2. LITERATURE SURVEY

Generally the robotic controllers are developed for position control, without accomplishing integrally the requirements of tasks in which interactions with the environment occur. However, this is currently one of the main research areas in robotics. To consider this interaction the robot controller has to give priority to the force control time response, because in the instant of end-effectors contact with the surface, several forces act on the system To achieve force control firstly concept of fuzzy-logy was developed. The control objective is to track the desired force and position trajectories simultaneously regardless of the unknown parameters of the task environment and the existence of the manipulator dynamics, represented as a fuzzy rule-base. The algorithm embedded in the proposed architecture can automatically update the fuzzy rules and, consequently, guarantee the global stability and drive the tracking errors to a neighborhood of zero[1].After that concept of open embedded architecture was discovered in 1992 at Ford that addresses issue of what is an open architecture robot controller. Three different classifications are defined along with the various advantages and shortcomings of each approach. Knowledge from past research and new technology development has been included in this analysis Limited survey of the diverse issues related to robot control design architectures is presented. Based on this review, an initiatory taxonomy of robot control tasks, motions, architecture and controllers is proposed [2].With help of this review framework of parallel force/position control for a robot manipulator in contact with a compliant environment, a new scheme is proposed which is aimed at controlling the end-effectors force in the face of uncertainty on the surface stiffness. The controller is of inverse dynamics type with force feed forward action. Adaptation to unknown stiffness is achieved by resorting to a suitable estimate update law driven by the force error. Tracking of both position along the unconstrained directions and force along the constrained direction is ensured. Experimental results on an industrial robot with open control architecture are present in 2007 at Lippielo [3].

But some problem had arisen related with both controlling and programming of position control. For this purpose, Element Contact Formation (ECF) is proposed to describe contact state. For different ECF has different force clustering, the modified FCM clustering is used for automatic classification of ECF in demonstration based forces information. Then from demonstration data the sequence of contact states and desired distances and velocities for transitions are obtained. The ECF identifier can be built with the similar degree between the force information and clustering. The skill acquisition module is implemented in robot controller with open architecture [4]. In the next step an intelligent prediction algorithm for robot force control is reviewed. The algorithm is not only applied to with open architecture controller is developed to test the force tracking effect when the environmental change in curvature and stiffness is taken into account[5]After removing all drawback open architecture for industrial or non-industrial robot controllers was design allowing system designers and robot manufacturers to develop rapid deployment automation solutions for particular mechanics of robot manipulators. The navigation and locating of the mobile robot platform, the motion control of the robotic arm, as well as monitoring, learning, program editing, debugging and execution are embedded in a multiprocessor system developed around a Motion[6].Recent development in robotic arm controller is that low cost open architecture PC-based controller for a planar is described. The system is based on an available low price commercial PC interface board and all of the control software runs on a Pentium 100 MHz computer to control the arm. The driving kernel of software for supervisory, management and control was developed in a high level language and enables the analysis of several position and force/position strategies for research and practical applications [7].In last few years back Field Programmable Gate Array (FPGA) design methodologies with a focus on Industrial Control System applications. The paper starts with an overview of FPGA technology development, followed by a presentation of design methodologies, development tools and relevant CAD environments, including the use of portable Hardware Description Languages and System Level Programming Design tools. They enable a holistic functional approach with the major advantage of setting up a unique modeling and evaluation environment for complete industrial electronics systems [8].In 2012 open embedded hardware and software architecture for industrial robot control was proposed. Here motion is controlled with help of PWM signal, width of signal is varied in accordance with lifting force. Then PWM signal is given to motor so that motor can run up to that extent.[9]

5. CONCLUSION

As we have gone through the literature and reviewed most of the recent developments it has been seen that robotic controller are developed for position control, without knowing the task in which interactions with the environment occurs .This leads to damages of object, however how to reduce errors is an main research in robotic areas. The proposed work mainly emphasis on force control to avoid damages by designing embedded system which control robotic arm through PC.

6. REFERENCES

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