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COOPERATING ROBOTS FOR MANUFACTURING AND ASSEMBLY FOR NEXT GENERATION

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ABSTRACT

Cooperating robots for manufacturing and assembly is used for automotive assemble by using its elements in the field of engineers in using the decision making process while designing and executing the assembly for the body in white. In this paper, we highlight the main issues which affect the performance of cooperating robots and its importance along with advantages and disadvantages by comparing the different scenario between the two. Also the scenario would be taken from two different cases which is based on conventional fix based configuration of robotic cell to perform welding operations and the features used for cooperating robotics cell.

Keywords- Cooperating robots, automotive assembly , designing and executing

INTRODUCTION

Fixed sequences of operations where manual and automated tasks are repeated in the same, optimum way during the duration of each cycle have been into the industrial assembly practice for long time. The model of this very standard while setting the production at the maximum through put but in some cases there are technical problems ad malfunctions. Moreover, flexibility is one of the important factor to adapt the changes while taking places in the market in the environment of global economic. We have gone through many different paradigm for discussion in this paper like the introduction of autonomous production units which also handles and capable of changing the task and position at the shop floor. These production and handling units are able to cooperate themselves and able to recover from the failures in robot by changing among the position or job. It also have auto reconfigured for the tools in order to answer quickly for potential production changes [1-4].

COOPERATING ROBOTS FRAMEWORK

The framework encompasses the following elements:

- **Reconfigurable tools-** It is the tool that accept the autonomous flexible assembly in order to adapt the production process easily for the disturbances process that integrate advances sensing capabilities.Mobile robotic can be easily transferred while using around the floor of the shop and it start taking tasks automatically with cooperation of the robots that were already installed in the assembly line, further enhances the configurability of the system.
- **Intelligent Control & Monitoring sy**stems enable the enhanced performance and high level configurability of production processes with the use of distributed and open controls linked to information from sensors. The module of monitoring and control utilizes a sensor which is driven approach to empower a distributed control framework which is based on service oriented architecture. It is enabled by tactile and non-contact sensors like machine vision or laser scanners for the

identification of technologies like RFID and many more. This makes recognition parts for the orientation of automatic grasping to handle and detect the disturbances if addressed in real time.

- Integration and communication architecture to enable the transparent integration and networking of the control systems by utilizing service oriented and ontology technologies.

Three main technology and scientific areas have been highlighted as enablers for advancing autonomy in assembly systems: a) Reconfigurable Manufacturing/ Assembly Systems (RMS/RAS), b) intelligent control methods and architectures and c) intelligent computing methods utilizing heterogeneous 'smart' objects.The concept of control logic have two levels of control that is the line and local level which is considered within the above discussed paradigm, these level are duplicated and examined which is more discussed in the below sections [5-7].

LOCAL CONTROL

Local control is basically a management between mobile unit and malfunctioning robot. Local control is very necessary for the operation. Cooperation scenario that is based on different unit level and coordination for robot is necessary between the mobile unit and malfunctioning. It is also depend on the task which need to be performed so that it could managed the advance tools for that for example, for handling task grippers are required which have multiple connection point so that it would able to provide great flexibility to enhance the passing of the gripper along with handled part from one to another robot. In these cases tolerance of assemble and not be compromised as the gripper are securely grasped by remaining parts of the handle [8-11]. It more be understood with the following workflow examples:

- From cell sensor, mobile service takes all information which is implement by an ontology to identify the task status and then receive the operations which are remained.
- The actions which are to performed is determined by the mobile robot service that is how gripper are picked up from broken robot and course of actions, points in space etc.
- Malfunctioning robot is communicated by the mobile robot to coordinate the exchange between the grippers.
- Once the gripper are exchanged , robot services adjust their motion is order to derive and evaluate new paths automatically to achiever the welding position which is required.
- After the finished task, the unit are moved to next are which are assigned and move towards it. Mobile production resources are used for mobile robots the scientific research. Year previously it was very extensive but there were restriction of industrial application in few cases that are operated under limited conditions like in the Automated Guided Vehicle (AGV).

  Few latest examples of robots are that it is use to increase the flexibility and utilise the robot cell which is called mobicell generally comes from BMW and the redundant robots utilisation from PSA. On the basis of mobicell concept , the robot cell can be moved from one to another plant and can put new production at new location in few days just like 2-3 days. However, the flexibility of this approach is limited due to ungainliness of the complete cell that to be moved and then installed. Whereas on the other hand the PSA are incorporated with 307 body shop for redundant robots that can take over the tasks automatically from mainline robots that were facing the problems. This can add flexibility to the body shop with fundamentals of the robots that were installed across the line and waited to use if required and can be used as a translated with an extra cost.

It is in cooperated and presented as a solution in an agent based control algorithm with multi agent systems which are categorized by application easiness, flexibility, configurability and divert capabilities. Industrial application examples have the agent-based control that have been reported within the cylinder head manufacturing facilities of DaimlerChrysler and in the case of an automotive engine assembly system. However, it faces such implementation that encounters problems and poor in actual assembly or in production environment because of the following:

- The absence of industrial controllers with multi agent system capabilities to enable the agents, running directly on controllers, in parallel with the low-level control programs and not separately on a personal computer which is the usual in today's case.
- The inability of the existing platforms to handle the great number of agents/services, required for the operation of real life assembly plants, and
- The interoperability issues, which in order to be solved require the use of standard platforms that support the transparent communication between distributed control components or applications.

Similar to the agents' concept, the Service Oriented Architectures have emerged as a means of controlling the manufacturing system and so far, they have demonstrated benefits such as: Installation time/cost reduction, Interoperability, Reduced complexity for technology suppliers, Programming time reduction, Maintenance optimization, Cost reduction through increased utilization, Optimization through better visibility, Reactivity through configurability, Reduction of human involvement in programming and fixing error which is finally creating legacy system support from the open interfaces.

Illustrating the structure of the open architecture as well as the decentralized nature of the local resource controls schemes to get the deep knowledge of cooperating robots for manufacturing and assembly. The units are the parts of the plants and each unit consists of comprising machines with their tools and they are bound to set the software components that is called services. The service are consist of the following:

- The identifying component that offers the necessary recognizing functionality
- The Control component, which utilises information from sensors and generates alternatives for reaction to environmental disturbance,
- The Networking component, which facilitates the communication from service to service.

OPEN INTEGRATION AND INTER MACHINE COMMUNICATION

The aim of this research in this area is to allow the networking control and open integration of the system by using the services that are oriented with the ontology technologies. In this area, open architecture of manufacturing system are important to allow for the automated realization of cooperative production systems which is required minimum programming efforts. These developments are expected to :

- Reduction of the practices of complex programming
- Reduce the existing centralized decision making with fixed control logic,
- Provide for, with generic control models that aim at replacing large monolithic software packages, developed and adapted case by case,
- Reduce the costs when implementing, maintaining or reconfiguring the control application, and

- Support efficiently the requirements, in terms of flexibility, expansibility, agility, re-configurability.

Robot software that are standard platforms are appeared with software developments kits to shorten the integration and robot development which are produced by robotic suppliers experts like in the open source initiative of the Robot Operating System that is ROS. Moreover, the concept of plug and produce are proposed in the direct analogy to have the concept of plug and play in the IT systems. Newly implemented holonic assembly system is based on the plug and produce concept which is use to addressed the systems but with manual adjustments with the robots setups. Though, many new industries identified it as the software which is remain the biggest challenge for the robotic research and the developers. The main challenges of applying service oriented architecture are the following:

- The service oriented architecture is expected to enable the execution of changes on the configuration of a line and the automated setup/calibration of the newly inserted components, via the use of software services and the interaction of a manufacturing ontology, aiming to significantly increase the autonomy of the production systems.
- The manufacturing ontology should be able to handle processes, such as knowledge capturing, analysis and classification and to use it for guiding the decision making at different levels (achieving both local and global autonomy and flexibility). Ontologies are definitely observed it as the means of solving interoperability issues within distributed production systems which are intensively becoming more knowledgeable.
- Implement a proper negotiation and decision making logic that will be generating alternative operation assignments for the production resources. Data that has to be exchanged between the production resources and the generation of production assignments during which the data and this data which are exchanged have to implemented in a way to communicate with the network which would not be overloaded and this make communication to prevent from the bottlenecks.
- Finally, the suggested approach, focusing on the use of open source operating systems, is highly significant as it enables the introduction of standardised software modules. Standardised software module are connected with the standardised signals interfaces that are programmed with the common open application programs interfaces and APIs. Therefore , the development which happen between the plug and play is more efficient and more fast. For the highest possible compatibility with the existing system it is to be ensures that the current open source initiatives are considered. Devices profile for web series and robot operating system are the examples of indicative.

CONCLUSION

Cooperating robots for manufacturing and assembly operations are studied as the enablers for the production of next generation systems. The current paper came into conclusion with the enablers that enable the autonomy and intelligent operation of manufacturing resources as a use of flexible and autonomous machines and devices managing a high variety of parts.Integrated control software, capable of being integrated in a variety of shop floor control systems. Intelligent control systems utilising information from sensors, exhibiting automatic decision making and monitoring functionality and Open communication architecture, allowing the transparent integration of new manufacturing components and their automatic operation. More work involves the examination and experimentation of various industrial scenarios.

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