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MODIFICATION OF INDUSTRIAL ROBOT

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ABSTRACT

The industry is moving from current state of automation to robotization, to increase productivity and to deliver uniform quality. The industrial robots of today may not look the least bit like a human being although all the research is directed to provide more and more anthropomorphic and humanlike features and super-human capabilities in these.

One type of robot commonly used in industry is a robotic manipulator or simply a robotic arm. It is an open or closed kinematic chain of rigid links interconnected by movable joints. In some configurations, links can be considered to correspond to human anatomy as waist, upper arm and forearm with joint at shoulder and elbow. At end of arm a wrist joint connects an end effector which may be a tool and its fixture or a gripper or any other device to work.

Here, the configuration of a robotic arm is changed such that two robotic arms are integrated into a single robot on a common waist with both the robotic arms performing the same operation. This will make a difference in the space occupied by an individual robotic arm and the time required to perform an operation without sacrificing the quality of performance.

INTRODUCTION

An industrial robot is a general-purpose, programmable machine possessing certain anthropomorphic characteristics. The most obvious anthropomorphic characteristic of an industrial robot is its mechanical arm that is used to perform various industrial tasks. Other human-like characteristics are the robot's capability to respond to sensory inputs, communicate with other machines, and make decisions. These capabilities permit robots to perform a variety of useful tasks. The development of robotics technology followed the development of numerical control and the two technologies are quite similar. They both involve coordinated control of multiple axes (the axes are called "joints" in robotics), and they both use dedicated digital computers as controllers. Whereas NC machines are designed to perform specific processes (e.g., machining, sheet metal hole punching, and thermal cutting), robots are designed for a wider variety of tasks. Typical production applications of industrial robots include spot welding, material transfer, machine loading, spray painting, and assembly.

Some of the qualities that make industrial robots commercially and technologically important are the following:

• Robots can be substituted for humans in hazardous or uncomfortable work environments.
• A robot performs its work cycle with a consistency and repeatability that cannot be attained by humans.
• Robots can be reprogrammed. When the production run of the current task is completed, a robot can be reprogrammed and equipped with the necessary tooling to perform an altogether

different task.

• Robots are controlled by computers and can therefore be connected to other computer systems to achieve computer integrated manufacturing.

LITERATURE REVIEW

Ritvars Grebers, Michele Gadaleta, Arturs Paugurs, Armands Senfelds, Ansis Avotins, Marcello Pellicciari: The energy consumption and electrical characteristics of a novel direct current (DC) power supplied industrial robot prototype are compared and analyzed with a state of the art alternating current (AC) supplied industrial robot. An extensive set of experiments shows an important reduction of the total energy consumption for different electrical power profiles measured in various robot trajectories with specific working temperatures. The recuperated energy is also analyzed in the different scenarios. Experimental results show that a DC type robot can be up to 12.5% more energy-efficient than an equivalent AC type robot. Richard Meyes, Hasan Tercan, Simon Roggendorf, Thomas Thiele, Christian Büscher, Markus Obdenbusch, Christian Brecher, Sabina Jeschke, Tobias Meisen: A major challenge of today's production systems in the context of Industry 4.0 and Cyber-Physical Production Systems is to be flexible and adaptive whilst being robust and economically efficient. Specifically, the implementation of motion planning processes for industrial robots, need to be refined concerning their variability of the motion task and the ability to adaptively deal with variations in the environment. In this paper, we propose a reinforcement learning (RL) based, cognition-enhanced six-axis industrial robot for complex motion planning along continuous trajectories as e.g. needed for welding, gluing or cutting processes in production. Our prototype demonstrator is inspired by the classic wire loop game which involves guiding a metal loop along the path of a curved wire from start to finish while avoiding any contact between the wire and the loop. Our work shows that the RL-agent is capable of learning how to control the robot to successfully play the wire loop game without the need of modelling the wire or programming the robot motion beforehand. Furthermore, the extension of the system by a visual sensor (a camera) allows the agent to sufficiently generalize the learning problem so that it can solve new or reshaped wires without the need of additional learning. It is concluded that the applicability of RL for industrial robots and production systems in general provides vast and unexplored potential for processes that feature variability to some extent and thus require a general and robust approach for process automation. Lars Larsen, Jonghwa Kim, Michael Kupke, Alfons Schuster: In times of industry 4.0 a production facility should be "smart". One result of that property could be that it is easier to reconfigure plants for different products which is, in times of a high rate of variant diversity, a very important point. Nowadays in typical robot based plants, a huge part of time from the commissioning process is needed for the programming of collision free paths. This mainly includes the teach-in or offline programming (OLP) and the optimization of the paths. To speed up this process significantly, an automatic and intelligent planning system is necessary. In this work we present a system which can plan paths for industrial robots. We compare widely used sampling-based methods like PRM or RRT with Computational Intelligence (CI) based methods like genetic algorithms.

4.1 ANATOMY OF THE MODIFIED ROBOT

The anatomy of the modified robot looks like the one shown in the Figure 4.1.

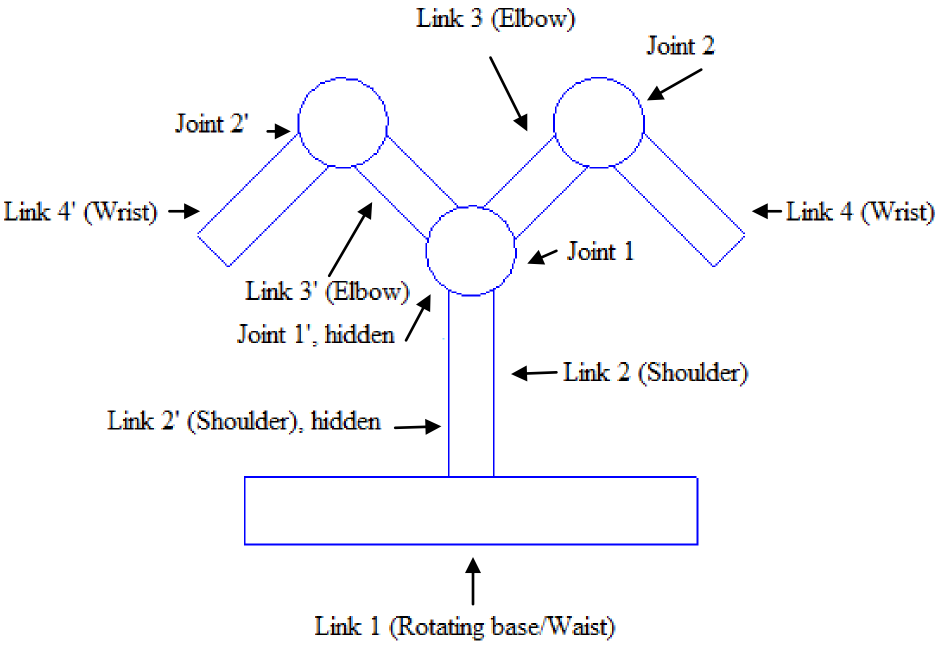

Figure 4.1 Anatomy of the modified robot

The above figure shows the anatomy of the modified robot which consists of two arms of the robot fixed to a common swivelling base ("Waist "according to industrial robot nomenclature).

4.3 FUNCTIONING OF THE ROBOT

The robot has two identical arms serving the same purpose with both the arms opposite to each other. The operation done by one arm is similar to that done by the other one.

This process will be similar to the situation when two individual identical robots are placed opposite to each other and are made to perform the operations simultaneously on opposite lines i.e., parallel lines.

The following figures of a Solidworks model illustrate the functioning of the robot during various stages of a pick and place operation.

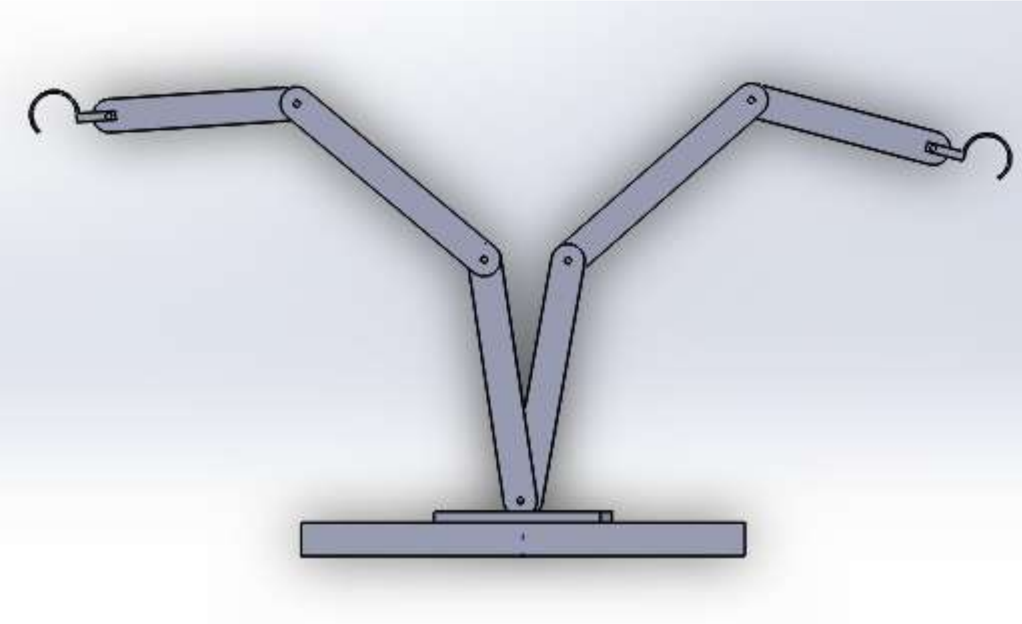

Figure 4.2 Structure of a pick and place robot

The above figure shows the Solidworks model of a pick and place robot with the modified configuration.

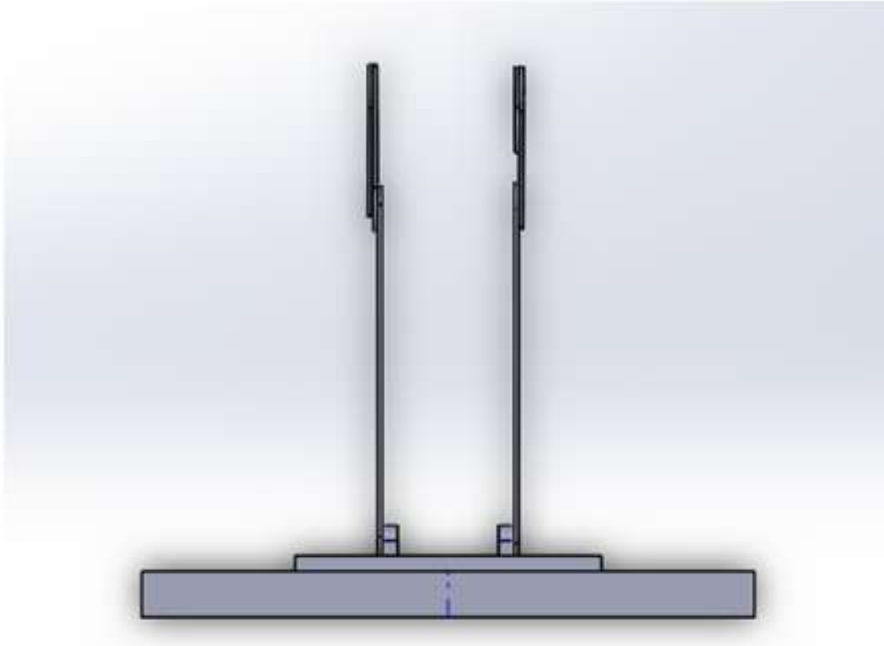

Figure 4.3 Initial position of the robot

Figure 4.3 shows the initial position of the robot. It is the position before the robot does any operation.

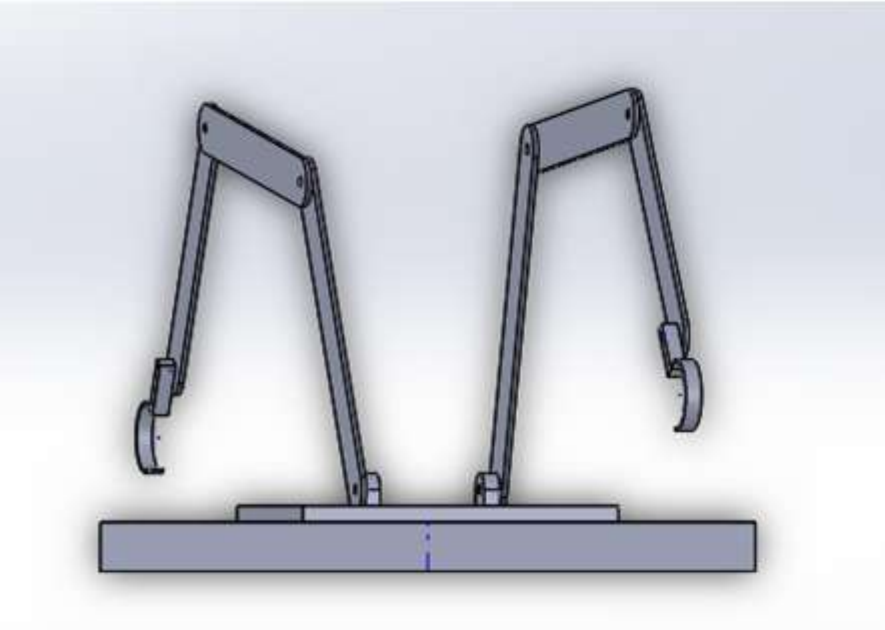

Figure 4.4 Position of the robot during picking of an object

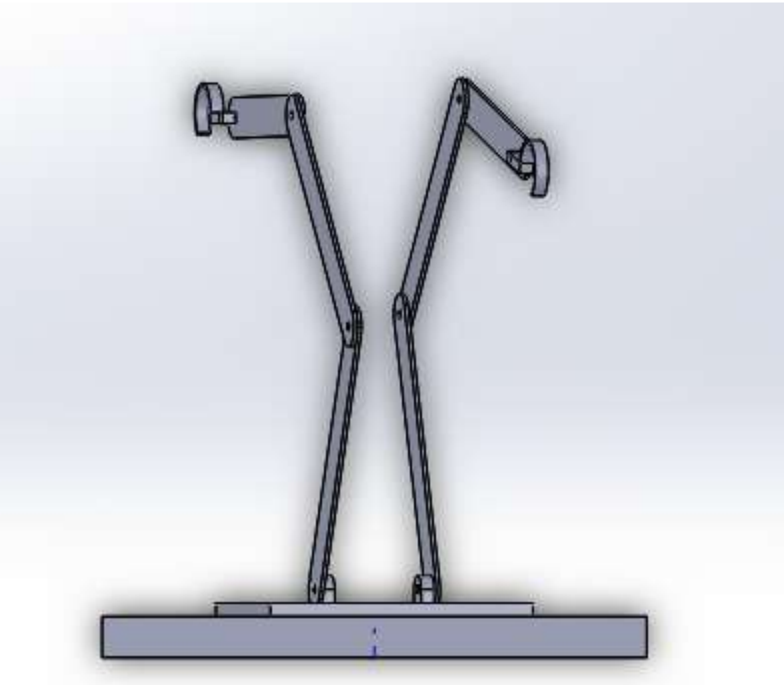

Figure 4.5 Position of the robot during placing of the picked object

The figure 4.4 shows the position of the robot while it is picking up an object. Both the arms pick up an object simultaneously at different places. The placement of both the arms of the robot is assisted by the common waist rotation.

The figure 4.5 displays the position of the robot while it is placing the picked up object. Thus the common waist rotation can be utilized by both the arms to pick and place the objects.

The above figures have demonstrated the functioning of this modified integrated robot. Adopting this configuration will help in reducing the shop floor space required for each robot. This will also result in the reduction of the input power given to the robot since there is only one waist in common for both the arms of the robot.

There will also be a reduction in the number of components required to achieve the robot control since both the arms can be controlled with a single set of controller system.

So it is more likely that this robot will save shop floor area, power input as well as the number of components required for the control system.

CONCLUSION

The project work presented here is a work on industrial robotics. The configuration of an industrial robot is changed in a way such that two identical industrial robotic arms are integrated into a single robot with two arms with a common waist. The effect of modifying the robot has been studied with an example of two robotic cells; one with normal robot configuration and the other one with the modified robot configuration. With the calculations involving a few assumptions, an approximate result has been obtained which can be concluded that the robotic cell with the modified configuration has occupied lesser shop floor space than the one with ordinary configuration.

Also, this modified robot has been studied with another application of internal painting/coating of vessels in which the obtained result is that the cycle time required to paint a single work part has been reduced drastically.

REFERENCES

1. Richard Meyesa, Hasan Tercan, Simon Roggendorf, Thomas Thiele, Christian Büscher, Markus Obdenbusch, Christian Brecher, Sabina Jeschke, Tobias Meisen, "Motion Planning for Industrial Robots using Reinforcement Learning", 2017, pp. 107-111.
2. Pini F, Leali F and Ansaloni M., "A systematic approach to the engineering design of a HRC workcell for bio-medical product assembly", Conference on Emeerging Technologies & Factory Automation (ETFA), 2015, pp. 1-8.
3. Chen F, Sekiyama K, Huang J, Sun B, Sasaki H and Fukuda T, "An assembly strategy scheduling method for human and robot coordinated cell manufacturing", International Journal of Intelligent Computing and Cybernetics, 2011, Vol. 4, pp. 487-510.
4. Tsarouchi P, Matthaiakis A-S, Makris S and Chryssolouris G, "On a human-robot collaboration in an assembly cell", International Journal of Computer Integrated Manufacturing, 2016, pp. 1-10.
5. Bobka P, Germann T, Heyn JK, Gerbers R, Dietrich F and Dröder K, "Simulation Platform to Investigate Safe Operation of Human-Robot Collaboration Systems", Procedia CIRP, 2016, Vol. 44, pp. 187-192.
6. Maurice P, Padois V, Measson Y and Bidaud P, "A digital human tool for guiding the

ergonomic design of collaborative robots", International Digital Human Modeling Symposium (DHM2016), 2016, pp. 105-111.

7. Tsarouchi P, Makris S, Michalos G, Matthaiakis A-S, Chatzigeorgiou X, Athanasatos A, Stefos M, Aivaliotis P and Chryssolouris G, "ROS Based Coordination of Human Robot Cooperative Assembly Tasks-An Industrial Case Study", Procedia CIRP, 2015, pp. 254-259.
8. Mårdberg P, Carlson JS, Bohlin R, Delfs N, Gustafsson S, Högberg D and Hanson L, "Using a formal high-level language and an automated manikin to automatically generate assembly instructions", International Journal of Human Factors Modeling and Simulation, 2014, pp. 233-249.
9. McAtamney L and Corlett, "A survey method for the investigation of work-related upper limb disorders", Applied Ergonomics,1993,pp. 91-99.
10. Ore F, Hanson L, Wiktorsson M and Eriksson Y, "Automation constraints in human–industrial robot collaborative workstation design", International Swedish Production Symposium, Lund, Sweden, 2016.
11. Stanton NA, "Hierarchical task analysis: Developments, applications, and extensions", Applied Ergonomics, 2006, Vol. 37, pp. 55-79.
12. Fasth Å, Provost J, Fabian M, Stahre J and Lennartson B, "From Task Allocation Towards Resource Allocation when Optimising Assembly Systems", Procedia CIRP, Vol. 3, 45th CIRP Conference on Manufacturing Systems, 2012, pp. 400-405.
13. A. Karim , A. Verl , "Challenges and obstacles in robot-machining", IEEE ISR, 2013, pp. 1–4 .
14. J. Pandremenos , C. Doukas , P. Stavropoulos , G. Chryssolouris , "Machining with robots : a critical review", International Conference on Digital Enterprise Technology", 2011, pp. 15-18.
15. Y. Chen , F. Dong , "Robot machining: Recent development and future research issues", Int. Journal of Advanced Manufacturing Technology, 2013, pp. 9-12.
16. L. Biagiotti , C. Melchiorri , "Trajectory Planning for Automatic Machines and Robots", Springer Berlin Heidelberg, 2009, pp. 76-79.
17. J. Merlet , "Optimal design of robots, Robotics: Science and Systems", Cambridge, Massachusetts, 2005, pp. 83-87.