

Automation Techniques and it's an Industrial Application: A Review

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Abstract

Automation has been introduced in industry to replace a repetitive task such as picking and placing object, manual welding, handling hazardous chemical as well as gripping the object, to reduce the cost of production and to reduce the cycle time required for production. Automation is able to manipulate the part at high speed. The starting installation cost of automation is very high but for long term use it is preferable. For small and medium scale production industries this is not preferable. For this low automation cost is necessary for profitable production. Also, Based on the research paper it is requirement of automation for spot welding of wheel hub. Because, it required skill operator and it has to pay cost. Therefore it needs automation. In this review papers we summarized the some automation technique for performing the task such as spot welding and pick and place. Moreover, the challenges come in manufacturing process like accuracy, precision, efficiency, productivity, quality with greater safety that need to be solved for future scope.

1. Introduction

Nowadays, Industrial robots and mechanical equipments are absolutely necessary for welding for mass production rate. Because manual welding takes more time for higher production rate there for industry not reaches towards daily production and also due to harsh work zone and heavy physical demand. As shown in Fig. 1.1 (Pires et al. 2003), for small/medium production volumes, robotic production yields the best cost per unit performance when compared to manual and hard automation. In addition to competitive unit costs, robotic welding systems bring other advantages, such as improved productivity, safety, weld quality, flexibility and workspace utilization, and reduced labor costs.

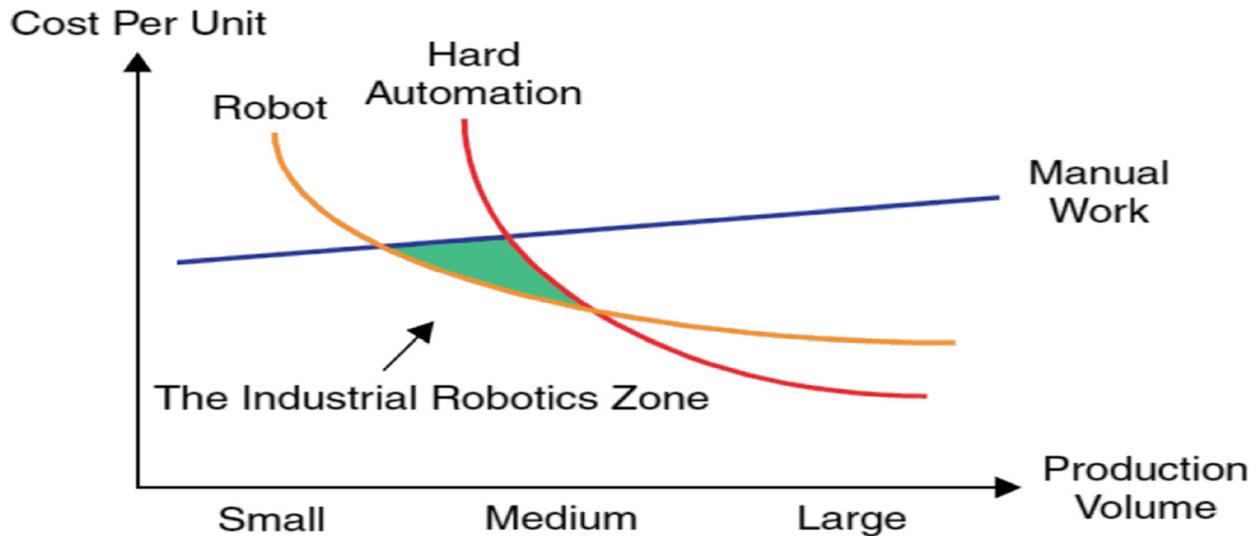


Figure 1 Industrial Robotic Zone. (Kah et al. 2015)

Automation welding technology has to reduce worker input and automatic control over the welding parameter. It helps to correct the path, control the quality and fault correction and fault detection. Automation gives better performance over the manual welding processes such as accuracy, precision, welding quality, productivity and safety. Although the starting cost of automation is high but for long term welding automation is necessary compare to manual welding. So, based on the research survey it was found that the spot welding of hub no work till has been done. For spot welding required skilled operator and it has to pay a cost. Therefore, industry demands welding automation.

2. Literature review

For welding automation lot of development has been done, in many papers found that the used of robotic technology as well as automation technique and different pick and place system. During welding spatters are fallen down and operator may injured and also it is difficult to handled the part safely. Therefore, industry demands for welding automation as well as automatic pick and place system. For this some literature survey was carried out. In this paper only pick and place system are reviewed with spot welding methods.

Recently, some researchers have done work on pick and place system as well as spot welding technique. Ashraf et al. (2011) deals to design and development of a competitive low-cost robot arm with four degrees of freedom for doing a simple task such as material handling. Servo motors were used for arm movements and robot arm limited to four degrees of freedom and allow only necessary movements and keeps cost. This robotic arm was made by acrylic material. Blanes et al. (2011) gives the technology used for robotic gripper in pick and place operations for fresh fruits

and vegetables. Robotic gripper is designed with correct manipulation, at high speed, in profitable P&P processes for industrial applications. Patil et al. (2013) present vision based pick and place robotic system. In this paper, the object recognition technique was reviewed, for this the scale invariant feature transform (SIFT) was used. Singh et al. (2013) author presents design of a robotic arm with gripper and end-effector for spot welding. For this AC motor is used with spur gear for doing the basic task such as pick and place, holding and grasping the object by means of DC motor. It forms the mechanism for spot welding. With the helped of this mechanism handling of component is easy. Yadav et al. (2013) deals with the study of applications of robot in industry as well as in different field of life. It was observed that after successful implementation of automation and robotic technology the production is increased. Magar et al. (2013) gives idea about implementation of robots for spot welding process with plc programming. It has been successful in reduction of cycle time with improved product quality and consistency along with safety. Omijeh et al. (2014) design and analysis of remote controlled pick and place robotic vehicle has been presented in this paper. In this paper prototype of remote controlled pick and place vehicle was built. This vehicle is used for handling a hazardous chemical where safety is most important. Complex and complicated duties would be achieved faster and more accurately with this design. Uralath et al. (2014) paper present the used of automation spot welding over manual. It results speed, precision, efficiency and the resulting cost reductions due to mass production. This paper discusses in detail about selection and applications of the two methods of spot welding. It gives advantages using a robot such as increased productivity, quality and better consistency. Chatterjee et al. (2014) paper presents a brief introduction to automation with its industrial application. After successful implementation automation for industrial application it achieves précised measurements and successful in minimization of costs in production with greater accuracy of product. Li et al. (2014) author presented work on design of a four DOF high speed pick and place parallel robot and proposed new methodology. Author was consider four interactive steps such conceptual design and mechanical realization of the light weight yet rigid articulated traveling plate, dimensional synthesis, structural parameter design for achieving good elastic dynamic behaviors and motor sizing. With the help of this steps achieves very good performance and successful in reduction of cycle time up to 150 picks/min. S. Sentil Kumar (2015) work deals with design of pick and place robot. It is observed that after successful implementation or robot for industrial used got some results such as increase productivity, to deliver uniform quality and safety. Work deals with robotic manipulator or simply a robotic arm. Mourya et al. (2015) successfully has been designed and implemented a pick and place robotic arm for industrial applications such as gripping of components, lifting of components, placing and releasing of components and focuses on designing a four DOF articulated arm for this servo motors was used. Sanketkumar R. Patel (2015) presents a review paper on design and analysis of pick and place using a vacuum gripper. In this paper kinematic analysis of robot have been done with selection of vacuum cup for varied weight of object during pick and

place application. The issues like constant vacuum pressure and handling a different weight of components. This problem was solved by defining vacuum pressure range and discussed optimal diameter of vacuum cup for maximum weighted object.

Case Study: Mrs Magar J.E et al. (2013) described the robots implementation in spot welding process. In manufacturing process industry always trying to minimize the cycle time required for welding because ultimately it will affects on production. Today's industry changes their manual manufacturing process towards automation. Author introduce the used of programmable logical control (PLC). Within industry many repetitive task such as pick and place the object, welding, spraying and in chemical plants for handling a hazardous chemical. This process has been successfully automated by giving plc programming to robots. Today plc has become the most common choice for industrial applications. Figure 2.1 shows the block diagram of plc

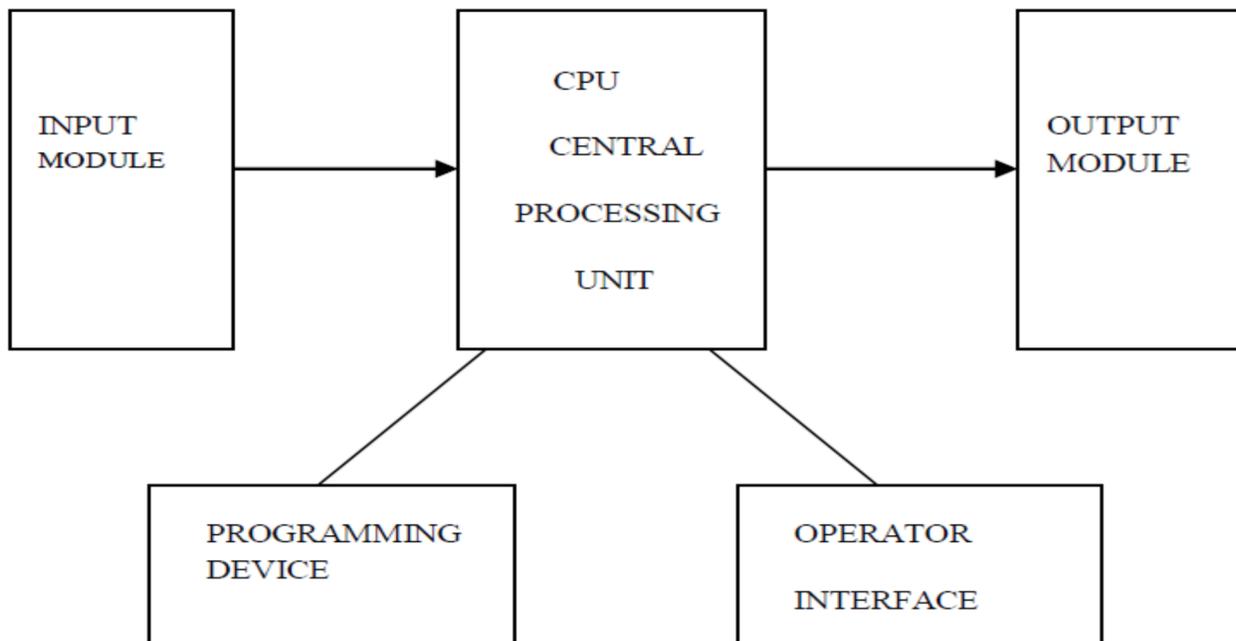


Figure 2 Block diagram of plc

In this paper welding gun consider and it consists of pair of electrode which was attached at end effector of robot and consider a sequence of operation through plc programming of welds car as it arrives on workstations. It was observed that assistance welding gun welds heavy mass compare to manual working at high rates of production. Figure 2.2 and 2.3 shows the relative motion of robot along x,y,z axis and relative actions of motor and sensors .

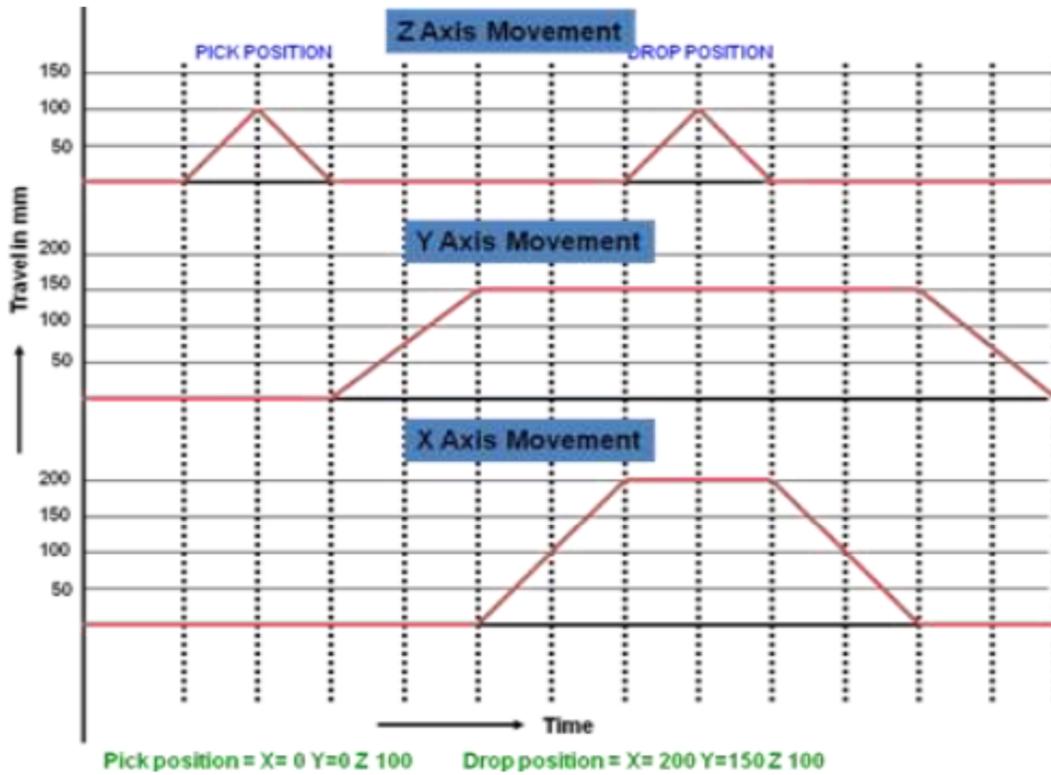


Figure 2 Relative motions of robot along x,y,z axis.

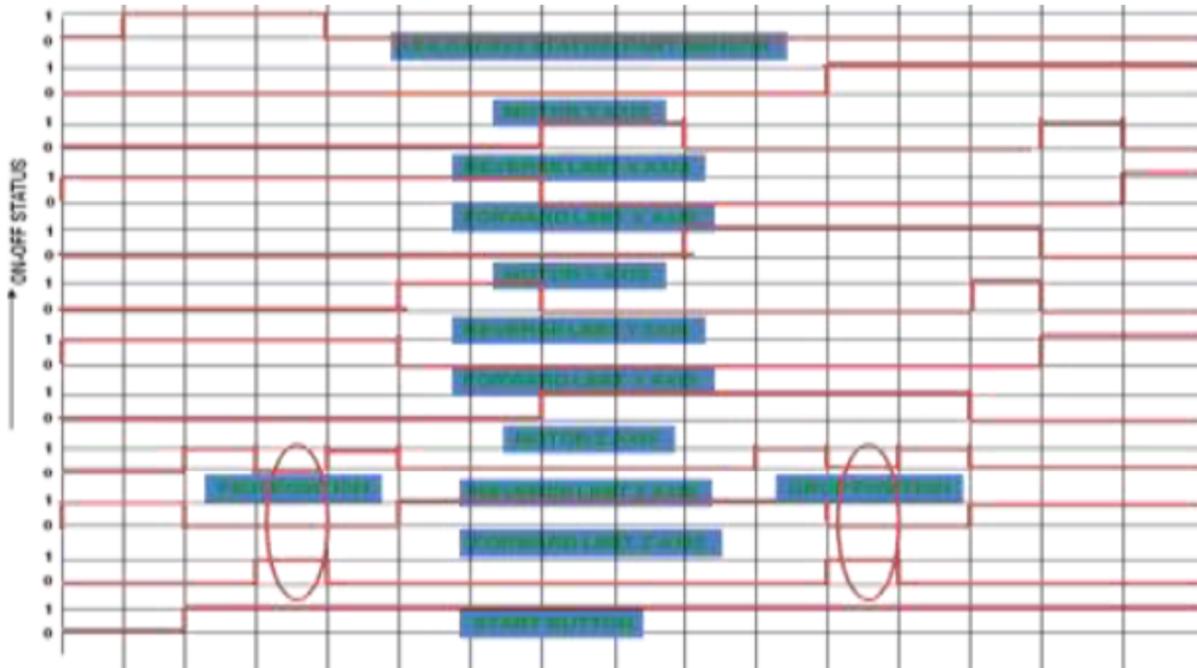


Figure 2 Relative actions of motors and sensors.

From this case study it is found that the automation gives the benefits by means of improved product quality, operator safety while welding, better feedback control and better control over production. Improved quality product it means consistent welds with safety means operator removed from welding stations where hazardous environments is there like electrical shocks and burns.

3. Conclusions

In this review paper some automation techniques are present for performing work such as picking and placing the object, gripping the object, welding the component and handling the chemical. After successful implementation of this automation, the technique was able to reduce cycle time for welding as well as for picking and placing the object and increases the safety of operator in various applications such as welding and chemical handling. Therefore it reduces the cost of production with improved quality and productivity.

4. Future Work

Many papers tried to give the automation techniques for performing the useful tasks such as welding, pick and place the part and handling hazardous chemical. But it is observed that no one has done the work for spot welding of automobile part (wheel hub). Basically this wheel hub consists of eight studs and it required indexing for spot welding with pick and place system. For this automation cost is very high and it will not be affordable to medium and small scale industry. So, it is decided to minimize the cost of automation for spot welding as well as it is found that no one has done combinations of design work such as indexing with pick and place system for spot welding.

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