Recent Development of Automation in Vehicle Manufacturing Industries

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Abstract—This paper presents the application of automation in different areas of motor vehicle manufacturing industry such as; robotic wheel loading, defect tracking in process, automated machine adjustment and restructuring, decision making, multi arm operation, final assembly and most important safety feature. In this work explore the present automation application and also find out the better way to implement in future to minimize the human efforts and time. These technologies based on the automation and artificial intelligence that will helps to make the process more efficient, stable and flexible. Moreover, aspects of changeability and adaptiveness of automation system have to be considered. The aim of this study to identified the opportunities and scope for future research trend in the field of automobile industries.

Keywords- Automation, Robotics, Artificial Intelligence

I. INTRODUCTION

Now a days, to meet the customer demand within time with higher accuracy is the major task. To satisfy the customer demands and for better performance Automation play an important role for various types of industrial like production, manufacturing, engineering, automobile, medical, defense, aerospace and space etc. The automotive industry is the most common user of industrial robots.as it involves a wide variety of tasks such as manufacturing and assembly which involves operations such as welding, cutting, painting, etc. a typical automotive industry consists of body shop, paint shop, chassis line and a final assembly line .in the body shop with the sheet metals the outer structure of the vehicle is formed, by the help of robots for spot welding, and material handling, and in addition the robots are also used to apply adhesives and sealer during the assembly.

The vehicle body is transferred to the paint shop and where it goes through various process such as cleaning, electroplating, priming, and final painting, and clear coating where usually all this process is carried out by manipulators for high accuracy ,and the manipulators are controlled by programs, next the painted vehicle is brought to the assembly line, where various parts are assembled on the painted body ,shell, and chassis .its includes all of the instrumentation and wiring system, panels, wheels ,monitoring systems etc. as the assembly process is very complicated hence the industry is relied onautomation [1].

II. LITERATURE SURVEY

Moreover, in the automotive industries wheel loading is the process to attach the wheels on the vehicle body when the production line is moving at some random speed .currently this task is done by workers manually working on shifts. Therefore the cost of wheel loading is nearly million dollars every year. Hence the automated wheel loading process is at higher demand .hence industrial robots have increased in industry because of their flexibility and accuracy. It can be done by visual servings and by macro-micro manipulators which increases the bandwidth of the system the manipulators are controlled by programs and directed by coordinates in the production line the vision system identifies the wheel hub position and orientation while the production line is moving a slight error can damage the car body .hence to improve the vision system various sensors, hybrid vision system, and intelligent control system to complete the complicated assembly process and huge amount of time and resource can be saved by adopting automation. Which will have great impact on the industry [2].

Thereafter, industrial robots have many usage in industry but fast and exact defect tracking system of industrial robots in case of incidents is one of the industrial problems which stops the production. As the robot is an electro-mechanical device it needs a periodic maintenance, a system is brought in front which detects the errors in the robot by using a program which is written in both prolog and oracle but prolog has more advantages such as it is logical and declarative language .and provides a simple environment so that is user friendly and it can be easily installed and executed in the computer and does not need any additional hardware.

The system presents the code of the appeared error on the display then the program finds the created defect and presenting proposal to remove defect. Each code represents a specific error and the cause and description of the error and the program also suggests the necessary action for the certain error, by this industrial revolution is accomplished, which better economic and social results. The program can recognize all kinds of robot error which occurs during production, preventing from long stop in production the program increases the ease of defect tracking of robots by labors [3].

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However, automated production has been increasing in the industry with the increase in the demand of accuracy, precision, higher productivity and quality, and also due to unskilled workers, as in the automobile industry the heart of the automobile is the engine, in vehicle the preparation of the engine to give the maximum efficiency is one the major expectations , amongst various losses in the engine, the various heat losses re the major losses which happens due to the valve clearances in the automobile which can be corrected by automation with high accuracy then with the manual operators, the valve adjustment machine is used in production operated by a control system , initially engine is fixed in the pallets and is conveyed to the center of the machine the upper dead point is fixed to the piston and is set with the indexing unit of crank angle where the valve clearance can be adjusted by the machine which leads tohigher efficiency of the engine [4].

Moreover, the industrial globalization of trades has increased in recent years and has changed the way manufacturing industrial relations. The industrial relations, under pressure to change similarly make that point that unions of the industry need to re think their role in society and become more involved in the decision making process of firms, in many cases technology especially CNC technology is either too expensive to purchase since of this a flexible automation unit is involved in the industry to produce automobiles as the automation can involve many industrial production changes and can meet the demands of the customer by time. As of using this high end technology the industry is taking a revolution in the field of automation production [5].

Moreover, industrial automation plays an vital role to increase the productivity, production, efficiency and also for reduction of energy consumption, for social demand and for the better development of the technologies as its final aim is to fulfill certain functions in the best efficient way by using the automated equipment as the production or operation in an industry involves production planning and coordination among equipment's. As this is very important and essential in various aspects in process operations and the automated equipment technologies purpose is to upgrade and allow new opportunities for equipment automation [6].

Thereafter, various companies are facing competition increasing on a global scale to satisfy the demands of the customers. The production unit of an automobile are experimentation on plants , as the automated systems are long lasting and reliable, for the automobile industries to adopt the increasing demand it is necessary to use the orchestration engine using PLC's , as to provide physical changeability and a ground level software to be generated automatically and can be implemented for the purpose of enhancing the manufacturing in the automobile industries as the automobile industries are at higher demand in the growing market, the use of orchestration engine in automotive industry can work in terms of pick and place unit , modelling and generation of the work planning in the unit and provision for prototypical applicability of other such approaches in the installments can be verified by the PLC's by coding ,which provide flexibility to the plant [7].

Moreover, an important component increasing the economy, the manufacturing of the product is defined as the product as closer to equipment originally manufacturing specification or in state , in this part the product that are used in returned to the original performance at least with a good condition warranty that is a better and that a new manufactured product , the remanufacturing should be done by keeping the customer requirement in mind and after manufacturing no point of repair or reconditioning the product should be done , the concept of this reverse logistics has good popularity in research , the theories are available on decision making for whether the product should be remanufactured or newly manufactured product must be chosen for the applications, this helps to know the manufacturing data that is useful in knowing the strategic decision making [8].

To overcome the issues in the assembly processes, highly functional multi-arm robot has been an indispensable element in the next generation production system. The development of standardized assembly uses highly rigid, Cartesian coordinates type manipulator for executing various assembly jobs this configuration can form the basis for the future assembly advancement process.in terms of mid to long range plans for quality and price competitive. The objective of the development was to do the, assembly job analysis.

The multi arm robot possess enough dexterity to carry out complex and both-hands assembly, and it has the flexibility to perform various types of assembly, and also the capacity to work at high speed operations .in addition it has a very narrow width to keep the assembly line short, and wide operating range and structured which ensures safety, visibility and accessibility which allows the robot to keep the down time to minimum levels. The dual arm allow the robot to work at various independent movements simultaneously. After realizing the complexity the advancement of the manipulators have also led to triple arm robot, it has reliable design and can perform various operations at assembly line and reduces the production time increasing the accuracy and productivity of the plant [9].

The potential opportunities and technical analysis of industrial robots. The automation technologies could be used in the future to automate the existing manual operations, it is also necessary to build a new production lines which develops and make improvements according to the changes of the human environment, to realize the safety of the worker it is necessary to study the hardware and software, based on the data acquired, the industry has to adopt the automation , as most of the operations in the industry ,the workers job itself rule the quality the product and the productivity directly hence the worker plays an important role in the industry hence high tech equipment ,the safe partner equipment is an automated equipment which guides and assists a series of human jobs such as material handling , positioning of machine tools etc. the equipment is installed in the work area, the equipment carries out the work and returns to the initial position automatically. The equipment also focuses on the weight reduction. Commercially reduction of the complexity of the work can be done by the integration of automation which makes the equipment compact, simple, reliable, and

easy to handle without stress [10].

Safety is The main objective of the every installation that may pose risk to human beings and environment, any type of work in the industry involves risk , which can be quantified and necessary safety measures can be taken to minimize the risks ,such as automobile industries we minute of mistake in any part can lead to cascade of problems as the automobile handles a lot of heat handling equipment's in it there will disasters if necessary safety measures are not taken, the safety in the automobiles can be increased by using the intelligent sensors or transducers where there are many fail safe architectures such as 1..10,1002TMR, etc. and a controller unit such as PLC's programmed by some ladder diagram programming to control the actuators and sensors. Which will lead to enhance the safety of the automobiles [11].

III. RESULTS AND DISCUSSION

The automobile industry is having a huge demand on the product but the innovation of new product is growing when the variety of product to be manufactured it reduces production volume and which causes the shorter development. The use of electric vehicles are also causes for innovation for the automation of product it requires the fixture as in case of innovating new product .it requires the fixture as in case of innovating new product it requires 25% of the manufacturing cost of product ,as the research is done in such that new fixture is developed with lower cost and flexible in handling the changing of fixtures reduces the flexibility but for the physical parameters of the different parts the number of fixture used can be reduced if the product variety is reduced & with which fixture development can be reduced and new can also be avoided even though fixture increases production in production system, investment cost is higher and if the dedicated fixture is used.

It reduces the flexibility and also limited to similar geometry and dimensions , if the high volume of production is carried flexible fixtures have lower reduction on amount of fixture required ,the results for the case with fixture body states that the changing of fixture becomes more economical also reduction variety in product, but in the recent days the use of electric and combustion vehicles, it is better to use the fixtures as they are more advantageous [12].

In a logistical industry there are many problems that should be solved in practice as they are stock piling distribution system, in the industry there is a lot of use of logistics in recent days for material handling, storage and transport systems in moving goods and raw materials, the major goals for the logistics are the inventory management, in a system such that the goods are available to covey at minimum cost, so in the use of logistics there is a lot of problem faced such as pollution, noise, climate change and other major problems in order to overcome these problems a new method of logistics are used which is also known as green logistics in which there is all facilities , the green house mainly concentrate on the greenhouse gases such as carbon dioxide, methane, and also waste disposal are also taken care and in the green logistics there is recycling of material ,for the use of green logistics in industry of automobile the use of system dynamics in the access of waste such as carbon dioxide and discrete event simulation is used for the determination opportunities in details as a result, it helps in the understanding of impacts and costs associated with use of DES complex operations can be monitored andthe green manufacturing can be obtained which also consist of the carbon emission trading and organic compounds [13].

The automated vehicle driving replaces the work of the drives from controlling the vehicle activity to supervising the action of the vehicle and in some cases it is just a fall back level, the use of machine interface has to give a support to the drive interaction , like handling control in the automation and should help in supervising the automation and driving vehicle , the driving the vehicle, the automations provides support to driver by informing about current task, action, and intention, that indicators help in providing a reliable level in the field of automation and the use of text boxers are to provide the messages to the drivers, when the automation is increased it ensures the trust and acceptance in the level of safety in controlling the vehicle, human machine interface helps the safety and using of automated driving in the ergonomic principles of these interfaces are taken into account the legibility may lead to mental loads and other visual problems when the information is provided human machine interface is received and display a good position out when the drivers expected that view might be in the position of failing to load and provide attention when required, the cause is to set the principles and design criteria of the initial set of data about the automation of the vehicle is provided and is made the research and this is the initial point and the automated vehicle is still emerging and this provides the guidance to the level of automation in the vehicle and verification of the automation with the vehicles [14].

The new technique is increased in the miniaturizing and in integration is done in all the industry in improving and developing the mechatronic application for the product, medicines and also in the field of the automobile the miniaturization is increased in the size and variety other than the PCB, new manufacturing techniques a new 3D technique is used in recent days like electrical circuits with 3D layout on polymers are produced in series and the portable devices are used to such as the mobile phones which are manufactured most in the Asia, in the research of a new material and method ofactivating can give good results, especially in the investigation of thermoset subtracts [15].

IV. CONCLUSIONS

The main challenge of vehicle manufacturing industries to make the balance between order- wining criterion of cost, time and availability of product without compromising the quality. In this paper we have discussed about the application of automation in different areas of manufacturing in vehicle manufacturing industries.

Moreover, still need to implement automation such as; priming and decking of windshield, hot – melt glue and seat loading. Apart from assembly and body shop nowadays, vehicle interior, vehicle comfort, memorized air conditioner, memorized seat adjustment and driver information system are still needs to actively explore the automation.

However, also need to increase the safety factor in the manufacturing process and vehicle safety also.

Several candidate processes for robotic automation were introduced and detailed to provide better understanding of the process in detail, underlying assembly requirements, practical issues involved, and potentials of the application of force feedback and real-time visual serving method under a moving line configuration.

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