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STUDY ON ROBOTIC MANUFACTURING FOR AUTOMOBILE

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Abstract—There are many types of robotic automotive assembly are used in industries. Large robotic arms with high payload capabilities and long reach move freely to spot weld car body panels, install windshields or mount wheels, while smaller robots are used to weld and mount subassemblies like brackets. All these are typical operations in international automotive factories. Fixture is device which is used to hold the work piece or fix the work piece and guide the cutting tool. The purpose of the fixtures is to provide strength, holdi ng, accuracy and interchangeability in the manufacturing of product. The objective of this project is to design and development of robotic assembles. We found that there is problem in auto assembly which required to be fixed within a minimum time by eliminating manual material handling with the help of ARK-2250 system. It is time consuming process. For assembling a auto parts Also skills and accuracy is required. So with the use of ARK-2250system time consumption for assembling auto parts is less. ARK-2250 systemmakes possible the handling and assembling of auto parts at higher speed with greater accuracy and with less skilled worker.

Index Terms —Robotic automation, APK- 2250, Automotive assembly etc.

I. INTRODUCTION

An assembly line is a manufacturing process (often called a progressive assembly) in which parts (usually interchangeable parts) are added as the semi-finished assembly moves from workstation to workstation where the parts are added in sequence until the final assembly is produced. By mechanically moving the parts to the assembly work and moving the semi-finished assembly from work station to work station, a finished product can be assembled faster and with less labor than by having workers carry parts to a stationary piece for assembly.

Assembly lines are common methods of assembling complex items such as automobiles.

Manufacturing robots give automotive companies a competitive advantage. They improve quality and reduce warranty costs; increase capacity and relieve bottlenecks; and protect workers from dirty, difficult and dangerous jobs. Car assembly plants use robots exclusively for spot welding and painting, but there are many other opportunities to use robots throughout the supply chain. OEMs, Tier 1s and other part producers all stand to gain from using robotics in the automobile industry.

Manufacturers turn to robots for many reasons. In the automotive industry, three of the biggest drivers are quality, capacity and safety.

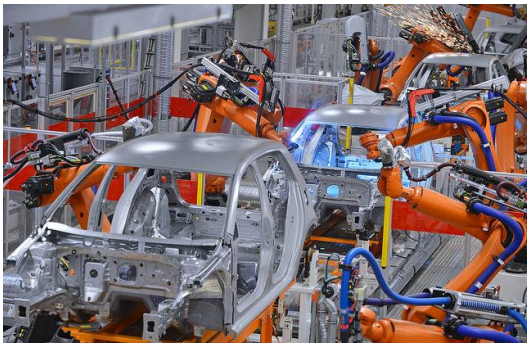


Fig. assembly process

II. LEARNING MORE ABOUT ROBOTICS IN THE AUTOMOBILE INDUSTRY

Car assembly operations and automotive part manufacturers are some of the biggest users of robots in the car manufacturing industry. Robots are easier to program and deploy than ever, but every integration project comes with unique challenges. That's why manufacturers interested in adopting automotive robotics should work with an experienced integration partner for design and installation.

III. AUTOMOTIVE APPLICATIONS FOR ROBOTS

There are thousands of parts in every car and truck, and it takes myriad manufacturing processes to make them. Advances in automotive robotics technology, like vision systems and force sensing, mean more of these than ever are suitable for robotic automation. Here are some of the best-suited application areas:

- **Welding (Spot and Arc):** Large robots with high payload capabilities and long reach can spot weld car body panels; while smaller robots weld subassemblies like brackets and mounts. Robotic MIG and TIG arc welding position the torch in the same orientation on every cycle, and repeatable speed and arc gap ensure every fabrication is welded to the same high standard.

- **Assembly**: Tasks like screw driving, windshield installation and wheel mounting are all candidates for robotic automation in car assembly plants. In many automotive part plants, robots like the high-speed "Delta" machines are assembling smaller component assemblies like pumps and motors.

- **Machine Tending**: Unloading hot moldings from an injection molding or die casting machine, and loading and unloading CNC machining centers are all good examples of robots tending production machines.
- **Material Removal**: Because it can follow a complex path repeatedly, a robot is an ideal tool for light trimming and cutting tasks. Examples include cutting fabrics like headliners, trimming flash from plastic moldings and die castings, and polishing molds. Force-sensing technology lets the robot maintain constant pressure against a surface in applications like these.
- **Part Transfer**: Pouring molten metal in a foundry and transferring a metal stamp from one press to the next are unpleasant jobs for human workers, but they're ideal robot tasks.

Painting, Coating and Sealing: Able to follow a programmed path consistently, robots are widely used for painting in car assembly plants, but are also good for spraying coatings like sealants, primers and adhesives. Plus, they can lay a uniform bead of sealant prior to assembly

IV. APPLICATION REQUIREMENTS

In addition to process control and information display, this project also had demands for data acquisition, edge intelligence, and remote monitoring control functions. For example, when the controller detects a potential problem based on the data it collects from sensors and actuators, it will automatically close down the process, issue alerts and alarms and send messages to remote computers, smartphones or other mobile devices used by management. So, the PC controller used in this case has to be equipped with suitable computing and data storage capabilities, and a software platform was needed for integrating IoT functions.
In addition, as the computer will be mounted on the arm of a monitor providing task information at each workstation for operators to view, the system needed to offer appropriate display outputs. The power, LAN, and all the wires and cables have to be securely connected to ensure operational reliability and stability. Industrial-grade ruggedness in terms of wide voltage and temperature range support was also needed for operation in the harsh manufacturing environment of a car production plant.

V. PROBLEM SUMMARY:

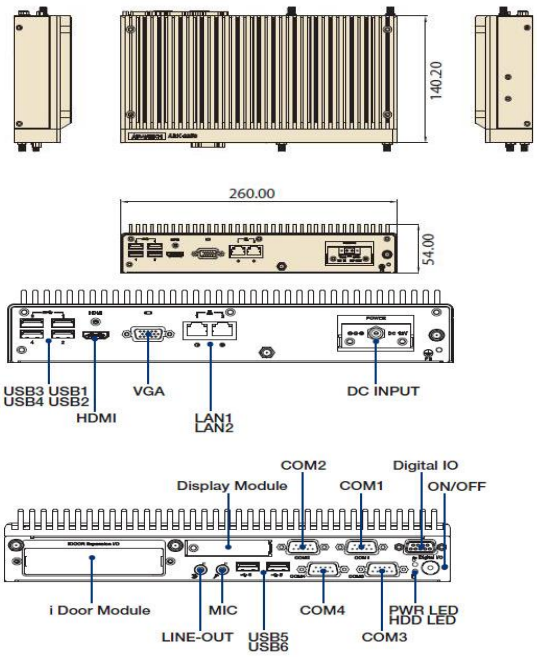
Today's business scenario is characterized by increase demand of product, faster response and mass production. To meet the current challenges it has become imperative for companies to increase the production rate of car manufacturing.

PROBLEM SPECIFICATION:

- **Automotive Manufacturing Quality loss**
- **Manufacturing Capacity**
- **Workers safety**
- **Flexibility**

VI. SUMMERY OF RESULT

At each workstation of the assembly facility, the Advantech ARK-2250, with appropriate power, LAN and HDMI interfaces, was mounted onto robotic monitor arms and connected to power, network, monitoring sensors, and actuators with lockable wires and cables; lest any wire or cable should fall off and cause operational failure or interruption. To enable data acquisition, data display and remote monitoring control functions, the ARK-2250, as well as the backend server, are deployed with Advantech's IoT WISE-PaaS/RMM software platform.
With the hardware and software provided by Advantech, the system will be used to provide information about the next item that needs to be installed in the assembly process, and display the information on the mounted monitor for onsite operators to view. Meanwhile, it will also collect and export data to an SQL Server database to archive production records and aggregate big data for future process improvement and system maintenance.
The ARK-2250 controller will also stop the process immediately when it discovers any problems based on data collected from the safety sensors, so as to avoid damage and reduce financial loss.
For display options, ARK-2250 provided HDMI, VGA, and optional 3rd party display interfaces, providing flexibility for different application scenarios.
Equipped with a state-of-the art Intel 6th Gen Intel® Core™ U-series (i3/i5/i7) processor, the ARK-2250 delivers high computing performance in a 260 x 54 x 140.2 mm (10.24" x 2.13" x 5.52") compact sized mechanical design to integrate nicely with the high speed automated automotive production lines.
Supporting a unique ARK-plus expansion module and i-Door I/O modules, the ARK system can be easily expanded to enrich storage and industrial interfaces on an optional basis. Industrial users like automotive makers, when retrofitting their production lines to produce new models, can rely on ARK computers which can be flexibly adjusted or upgraded for reconfiguration to meet design changes with minimum extra capital investment.



A. Automotive Manufacturing Quality Gains

Car manufacturing robots reduce part-to-part variability. Highly repeatable, they never tire or get distracted, so every cycle is performed the same way. Neither do they drop parts or handle them in a way that causes damage. That reduces waste previously caused by human error, and it also means less variability in car assembly. Equipped with vision systems, automotive robots can even detect variation in incoming materials and adapt their programmed paths to suit. This, in turn, translates to higher customer satisfaction, fewer mistakes and lower warranty costs

B. Addressing *Manufacturing Capacity*

Automotive supply chains run lean with minimal inventory to buffer against production delays. Automotive part manufacturers strive for consistent times, and consistent process control in every step of the production line. Even the smallest problem can stop an assembly line. Robots don't suffer end-of-shift fatigue, so cycle times are constant all day, every day, and peak production rates are consistent. What's more, running robots through breaks and shift changeovers yields additional output from production lines when compared to manually attended lines.

C. Protecting Workers

Many jobs in automotive manufacturing are hazardous. Sometimes, the dangers are obvious, as when pouring molten metal in a foundry. Other times, they're more insidious, like the musculoskeletal disorders resulting from lifting, twisting and repetitive motions. Robots can prevent these risks to humans. In car assembly, robots keep workers from exposure to fumes from welding and painting, as well as weld flash and the noise of stamping presses. Automotive robotics cut accidents and injury claims by removing workers from these dirty and dangerous tasks by removing them from these environments

D. Adding Flexibility

Automotive robots have three advantages over hard or dedicated automation.
Minimal changeover time from one job to the next. Flexible gripper design is often all that is needed to load a new part program.
Ability to handle product families.
Whether it's car assembly line robots, spot welding different vehicle body styles in quick succession, or a compact machine trimming flash from a range of plastic moldings, robots have the flexibility to switch almost instantly. By using vision systems or other technology like RFID tags, it's possible to process a wide variety of parts.
Less risk of obsolescence. When a product line disappears, the robot can be redeployed with little additional or no cost. In contrast, hard automation usually ends up being scrapped.

VII. BENEFITS

Reliable fan less/wide-voltage/wide-temperature/ lockable cables designs ensure reliability and stability for industrial applications
VGA /HDMI/optional 3rd party for versatile display
High computing performance and rich I/O support accommodates data collection and analysis requirements
Pre-installed WISE-PaaS/RMM software to enable data acquisition and remote monitoring with easy connection and fast deployment
Longevity support with long availability of Advantech products and services

VIII. CONCLUSION

Although numerous robotic manufacturing techniques have been proposed and implemented, robotic manufacturing still continues to be a major bottleneck in the integration of assembly activities. One reason for this is that robotic manufacturing approaches being developed are not fully integrated with other product and process design activities. Although researchers have analyzed and studied ways to automate the methodology, there has been little work on developing methods which support the assembly of vehicle in a concurrent engineering (CE) based team-oriented environment. Future robotic manufacturing approaches must focus on methods which not only serve as a bridge between assembly of vehicle, but, more importantly, seek to support cross-functional participation and concurrent engineering approaches. Such approaches will help other members of CE teams understand the problems associated with potential solutions when evaluated in the context of the overall design/manufacturing cycle involving other specialists such as product designers, managers, assembly specialists and shop floor planners, among others.

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