A COMPREHENSIVE STUDY ON INDUSTRIAL ROBOTS

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ABSTRACT *"A robot is re-programmable, multi-functional controller intended to move material, parts, instruments, or concentrated gadgets through factor modified movements for the execution of an assortment of assignments." Robotics can be characterized as the science or investigation of the innovation essentially connected with the plan, manufacture, hypothesis, and use of robots. Robotics is a science using the continuing advancements of mechanical engineering, material science, sensor fabrication, manufacturing techniques, and advanced algorithms. While different fields contribute to the science, the strategies, and the segments, mechanical autonomy make the enchanted finished result. The practical applications of robots drive the development of robotics and drive advancements in other sciences in turn. Crafters and analysts in mechanical autonomy think about something other than apply autonomy. Robots hold the confirmation of moving and changing materials as per program feed in the controller memory*

Keywords:

INTRODUCTION

HISTORY OF ROBOTS IN INDUSTRIES

Robots have for quite some time been the focal point of sci-fi, Physics, and writing, however, it wasn't until late decades that they turned into a feasible piece of our workforce. While created utilizing fiction, these gauges practically portray our robots today. The change of Numerically Controlled machines, and the rising reputation of the PC both acknowledged out the fundamental present-day robots.

OBJECTIVES OF THE STUDY

- To understand the logic and conceptual of Robotic automation and its requirements in industrial automation development.

Initially, fuel and electrical engine were used and it had four to five-axis of rotation. After a decade robot was introduced and make them fully automatic.

ESSENTIAL CHARACTERISTICS FOR ROBOTS:

Part sensing: Robot have capability to sense the part or the material and detect as per the programmed feed robot part sensors: light sensors, touch and pressure sensors, hearing and sonar sensors , chemical sensors and taste sensors will give your robot awareness of its environment.

Arm movement: A robot can move around the required direction.Moving on wheels, strolling on legs or driving by thrusters a robot should have the capacity to move.

Energy: All robot have control unit so they control itself. Robots are electrically powered, battery powered. All such power supply required as per robot specification and their features.

Intelligence: Robots are intelligent device it act as like as human and they can be programmed in any likely manner.

Path arrangement: to decide how to move about its condition utilizing the accessible degrees of opportunity .This might be the movement of an arm to lift something up or it might be a progression of developments to physically move it from area 1 to area 2

The robot usually has a 3-phase sequence of operations: sense (perception), process (interpretation and planning), action (movement of some kind)

ROBOT FUNCTION

- Create a particular movement of joints
- Incorporate tooling and sensors

ROBOT PROCESSES

- Way following
- Dell Setup moves
- Tele robotics
- Target moves versus educated moves

SOME KEY EXPRESSION OF ROBOTS

- Repeatability - changeability in returning to the same beforehand taught position/configuration
- Exactness - changeability in moving to a target in space that has not been previously taught
- Device speed - Straight speed ability when instrument moving along a curvilinear path
- Screw speed - Rotational speed when the tool is being rotated about an axis in space
- Joint interpolated motion - Movement where the joint setting aside longest opportunity to roll out the joint improvement oversees the movement and alternate joints are hindered in extent with the goal that all joint finish their joint changes at the same time
- TCF - Tool or terminal control frame
- TCP - Tool /terminal control point
- Joint limits - Either the software or physical hardware limits which constrain the operating range of a joint on a robot. The software limits have a smaller range than the hardware limits.
- Joint speed limits - Speed restrain for robot joints, which restrict how quick the connections of a robot may interpret or rotate.
- Point-to-point motion - Described by beginning and halting between arrangements or as the apparatus is moved between targets.
- Continuous path motion - Portrayed by mixing of movement between arrangements or targets, for the most part with the loss of way exactness at the objective changes, as the robot moves between arrangements/targets.
- Interpolation (kinematic) capabilities - Robot typically fit for both forward and backwards kinematics. Both consolidate to give the robot the capacity to move in joint space and in Cartesian space. We normally allude to the moves as joint, direct, or round addition.
- Forward kinematics - Specifying the joint values to accomplish a robot move to a new configuration in space. These may not be simple as it seems because secondary joints such as four-bar linkages, ball screws, etc. may be required to accomplish this motion.
- Inverse kinematics - Solving a mathematical model of the robot kinematics to determine the necessary joint values to move the tool to the desired target (frame) in space. This is accomplished by frame representation whereby a triad (XYZ axes) is attached to the tool on the robot and a target frame is attached to the part or operating point in the work cell. The inverse kinematics determines the joint values required to align the tool triad with the target triad.
- I/O - Input/output which consists of ON/OFF signal values, threshold values, or analog signal values which allow the control of or response to external devices/sensors as required to sequence work cell operations.
- Programming language - The language and logical constructs used to program the set of operational instructions used to control robot movement and interact with sensors and other cellular devices.
- Multitasking - Ability to process more than one program at a time or process I/O concurrently.
- Load capability - Force and torque capability of the robot at its tool interface
- Teaches Pendant - Operator interface device used to teach/save robot configurations and program simple instructions.

INDUSTRIAL ROBOTS

An industrial automatic robot designed and developed in such a way to move object, parts and perform the desired task as per program feed in the controller unit as per production requirement of any product.

Industrial robots are going to give new mirror or new birth to the automotive and all the manufacturing sectors industry. They are often used to perform duties that are dangerous or unsuitable for human workers. Ideal for situations that require high output and no errors, the industrial robot is becoming a common fixture in factories. The industrial robot is a good fit for many applications. It is most often used for

arc welding, material handling, and assembly applications. They are grouped according to a number of axes, structure type, size of the work envelope, payload capability, and speed. A robot controller provides the interface for programming and operating the industrial robot. A device called a teach pendant is used to plot the motions needed to perform the application.

Latest upcoming industrial robots having MCU (micro controller unit) inbuilt module and it is not governed by other device and it is designed for dedicated special purpose machines. Other fixed placed industrial robots should not be included in the statistics.

An industrial robot is a programmable, multifunction; manipulator designed to move materials, parts, tools, or special devices through variable programmed motions for the performance of a variety of tasks.

A machine formed by a mechanism, including several degrees of freedom, often having the appearance of one or several arms ending in a wrist capable of holding a tool, a work piece, or an inspection device. In particular, its control unit must use a memorizing device and it may sometimes use sensing or adaptation applications to take into account environment and circumstances.

IMPORTANCE OF INDUSTRIAL ROBOTS

Industrial robots can take place of humans in the hazardous work area with accuracy and timeliness. Robots are controlled by the controller and can be easily programmed.

On the off chance that there is one innovative progression that would absolutely make living simple and advantageous, the robot would be the appropriate response. They have demonstrated noteworthy in diminishing the human work stack, particularly in businesses. Robots are human like machines equipped for doing errands they are modified to do.

Robots are generally used in the assembling business. Individuals who do a similar thing for a significant lot of time have a tendency to get exhausted and tired of what they are doing and may touch base in a position wherein he is unwillingly doing his activity. The sort of employment that workers experience in this kind of business is generally dull and dreary. The individual who achieved this point won't be as productive and powerful as when he initially began working. Likewise, as the person we get depleted so the time allotment that we can work is just restricted.

The enterprises picked up a ton of advantages out of robotic technology. The association viability has risen which affected associations to achieve more advantages. Despite what might be expected, the rise of modern robots expedited burdens workers. Likewise, organization misfortune has been decreased in light of the fact that defective items are trimmed down to none. Thus, the joblessness rate goes higher. Numerous underprivileged individuals end up poorer while organization proprietors which are just a couple get more extravagant. There have been stories exhibiting that these machines have ended up being adequately shrewd to think and act self-rulingly and expel humanity. The cerebrum of robots where they get an arrangement of guidelines that influence them to perform assignments consequently is called man-made reasoning. In plain view, this is no place near happen since robots nowadays are not adequately ready to do assignments without being controlled.

CAPABILITIES OF AN INDUSTRIAL ROBOT

The usage of robots improves adequacy and accuracy on a grouping of employment. Robot limits keep running from tackling minor errands to mechanical methodology like welding and exhausting to working with individuals encountering medical procedure. Robots are contraptions/machines that are controlled by a PC. They save time and money as they exchange human work for dangerous or dull assignments. Since they never create tired, they can work expanded periods in ruthless circumstances. Applications, for instance, gathering, welding, painting, thing examination, picking and putting, fail horrendously tossing, entering, glass making, and grinding are by and large master by robots. They are used to encourage authorities and help with tasks in the remedial field, and can in like manner regulate pharmaceutical drugs.

Various endeavors depend seriously on robots, including flight, auto, buyer items, contraptions, metals, sustenance and drink, foundry, restorative, military, pharmaceutical, plastics, and wood.

Show day robots are outfitted with vision development that empowers robots to "see." Vision-guided robots can perform activities, for instance, stacking and purging a vehicle line, despite when objects are orchestrated indiscriminately. They can adjust to developing circumstances and can keep up a key separation from obstacles in their ways

ROLE OF ROBOTIC AUTOMATION IN INDUSTRIES

Today's scenario automation plays a leading role in manufacturing plants. Role of robots in the smart factories increase day by day. It makes things simpler and faster. the human role can be replaced by Robotic

automation in many of the areas in the smart factories. Many of the robots are used in manufacturing assembly; few of the applications as shown in three categories:

(1) Automated material handling,

(2) Production processing operations, and

(3) Assembly of products and inspection of their components.

Automated Material-handling applications include material transfer from one position to another and material assembly loading and unloading. Material-transfer from one stage to another stage applications need the robot to transfer materials or parts assembly from one position to another position. Few of these jobs are relatively simpler, need robots to pick up assembly from one belt conveyor and put them on another belt conveyor. Other moving operations are very typical, such as placing parts assembly onto pallets in an arrangement that must be mathematically calculated by the automated robot. Machine loading and unloading operations utilize an industrial robot to pick and place parts at a production assembly line machine. This needs the robot to be designed with a hand gripper that can hold the parts. Usually the hand gripper must be equipped specifically for the identical part shape and size.

In production processing operations the industrial robot manipulates a job to perform a various production process on the work part assembly. Few examples of such applications contain continuous arc welding, spot welding, and spray painting. Spot welding of car and vehicle assembly is one of the most common uses of industrial robots. The robot makes the particular position of a spot welder beside the automobile panels and covers to finish the assembly of the basic car and vehicle body. Arc welding is a running process in which the industrial robot moves the welding bar along the side to be treated for welding. Spray painting contains the manipulation of a spray-painting gun over the area of the object or machine to be painted. Another operations in this catalog include polishing, and routing, in which the robot tool serves as rotating spindle.

Assembly of products and inspection of their components. The application of industrial robots in the assembly line is expected to high due to the high cost of manual labor for such operations. The industrial robots are programmable, in assembly line work station is to produce multiple product types of different customer executes in batches, reprogramming the industrial robot as per new batches.

The product design plays a very important role in robotic assembly. product designs in such a way that the parts are to be integrated from the similar direction using snap fits of mechanical assemblies and another one-step fastening of the screw in the same direction enable the work to be accomplished very for robotic assembly methods.

Inspection is another area of manufacturing operations in which the uses of robots are enhancing day by day. In any type of inspection work, the industrial robot positions a camera sensor with respect to the part assembly and determines whether the part is ok or not as per quality aspects.

LEAN MANUFACTURING AUTOMATION

The core idea and vision of lean manufacturing is actually quite simple, proper way and relentlessly work on eliminating waste from the manufacturing process and improve product quality.

So what does waste means? Waste means any task or the work that does not value added from the customer's point of view. According to research conducted by the Lean Enterprise Research Centre, fully 40% to 50% of production activities, task or work content in a typical manufacturing operation is waste – they add no value at all for the customer.

The good news is that just about each and every company or every manufacturing industry has a tremendous or huge opportunity to improve, using lean manufacturing techniques and other manufacturing best implementations and ideas. Techniques and ideas that enable or activates you to deliver or to produce higher quality products at significantly few men power and lower costs. Now that is something to get excited about!

It can be difficult to find and generate reliable and well-written information and ideas about improvement techniques for manufacturing of products. So, our goal and vision are to provide you with the absolute

best source of easy-to-understand information for helping you improve the profitability, efficiency, and effectiveness of your manufacturing operations.

MANUFACTURING AUTOMATION MIGRATION STRATEGY

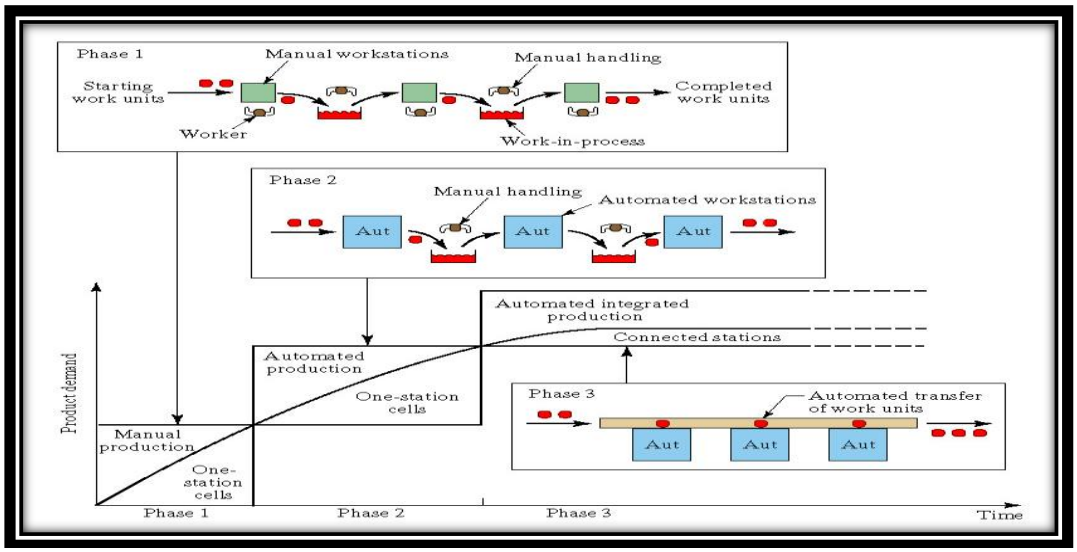
In this competitive world environment, each and every company need to develop and introduce new products in mean time frame. In the production demand, the manual tooling can be done at low cost. With the help of such single setup production can be done for some quantity of products and meet customer demand. If the product launch by the company is successful and it will make a boom in the future market then they have to automate the production automatic for demand-supply. Each and every company have different migration strategy and improvement in the production test setup can be done in any phase.

A manufacturing automation migration strategy is the following:

Phase 1: In Production Cell When Any Body Can Work Independently Then Single Can Be Done. Such Types Of Single Setup Cell Is Generally Used For Proto And Pilot Of Low Volume Products.

Phase 2: If the production of any of the product is going to be increased then it is clearly visualized that automation is required. Then the single work station will be completely automated which impact to reduce in labor and increase in production.

Phase 3: in this phase, all the production setups are fully automated.As per this phase if the company having lots of order and lots of production then they have to automize the production test setups and make all the arrangements in such a way that at the time of shift changeover it can be done easily without disturbance. Due to this high quality and high volume product can be produced.



Manufacturing migration on automation strategic plan.

CONCLUSION

Ten types of strategies for manufacturing automation and production systems

1) **Operations specialization.** Operation specialization contains the man and machine capability and their efficiency. So need to analyze specific machine and educated specialization labour to carry quality work.
2) **Combined operations.** Combined operation production indicates that the all the machine or the equipment lie or installed together. Due to that, the handling of the component and material will be easy and quality of work can be maintained. Due to the combined operation of all machine, there will be an impact on labour cost, one person can handle various inline machines.
3) **Operations in the Simultaneous way**. As we seen in above-combined operation that all the machines installed in combination to one another, if all the machine work will be simultaneous then it will decrease our processing time and increase the output quality.
4) **Combination of operations.** combined of the various cell into a merged cell, using the automatic pic and placed machines or the equipment. Its output, this reduces the quantity of various types of machines.

5) **Amplified flexibility.** Each and every test setup in production have less setup and programming time.
6) **managing and storage of Fabric.** Managing and storage or product are critical can be easier to identify the type and where the part has been located can be identified easily and also improve production cycle time.
7) **On-line vision inspection.** Online vision inspection plays important role in first time right product dispatch to the customer. Manual visual inspection is not up to the mark for the final product. At last stage of every production, auto inspection machine detect if there is any wrong marking on the product or the product from different order or tye. Online vision inspection leads to high-class quality of deliverables.
8) **Process optimization and management.** It impacts to process optimization and manage the process and man power. If the man power of operation plant get managed than it will increase in productivity and improve in product quality.
9) **Manufacturing Plant manipulate**. Different product portfolio and different types of operating process and procedure in manufacturing plant. Plant manipulate is approach to combine control and observe the activity of every section.
10) **Computer-integrated manufacturing.** Computer integrated manufacturing having in total control of all the production in one screen. All the process and system running on the single screen of the computer. The Main benefit is to identify the focused are to work. Anybody can sit anywhere and look the performance of process plant.

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