INDUSTRIAL ROBOTICS

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Abstract - *Robotics is a branch of applied science, the popular conception of which came not from science, but from drama, fiction and cinema. The word "robot" was first used in 1921 by Czech playwright Karel Capek on his play "Rossum's Universal Robots" when robots where machines resembling human beings except that they were exceptionally hardworking. The word "Robotics" which means the study of robots, was later coined in 1942 by science fiction writer Isaac Asimov in his story "Runaround" where he put forward three "laws" of robotics. Science fiction writers including Asimov and film-makers used the concept of robots widely and projected robots as human-like mechanical "beings" with tremendous physical and intellectual capabilities, compared to which even the most sophisticated robots of today will look very primitive.*

***Key Words*: Robotics, Czech, Karel, Asimov, fiction etc**

1. INTRODUCTION

Industrial robots as other modern manufacturing systems, are advanced automation systems that utilize computers as an integral part of their control. Computers are now vital part of industrial automation. They run production lines and control stand alone manufacturing systems such as various machine tools, welders, inspection systems and laser beam cutters. Even more sophisticated are the new robots that perform various operations in the industrial plants and participate in full automation of factories.

A revolutionary change in the factory production techniques and management is predicted by the end of the twentieth century. Every operation in this factory of the future, from product design to manufacturing assembly, and product inspection would be monitored and controlled by the computers and performed by the industrial robots and the intelligent systems. It is well to keep in mind that this automatically controlled factory is nothing more than a new phase in the revolution that began in the Europe two centuries ago and progressed through the different stages.

2. Construction

A robot generally consists of 5 main essential parts

- A controller connected to a computer,
- An arm,
- Drive, (Engine)
- End effectors, (Acted as a hand attached to the robotic arms – tools)
- actuators and sensors.

An Arm:

The arm of a robot as an important part of the robotic architecture. Most of the robotic arms resemble the human hands having fingers, wrists, and elbows. A servomotor is used to actuate the arms.

Fig – 1: Arm of Robot [1]

End Effector:

The end effector is the hand which is connected to the arm. Depends upon the applications/ uses the robotic the end effector can be of various shapes and sizes.

Fig – 2: End Effector of Robot[2]

Controller:

The controller is connected to the computer network Systems, so that the robot may work together with other robots or machines. The controller functions as the "brain" of the robot.

Drive:

Most of the robotic drives are made by using D.C. motors. The drive is the engine of the robot. It enables mobility and movements between the joints of the arm.

Actuators:

They are generally muscles of a robot. The actuators mechanism can be achieved by using electric motors/ hydraulic systems/ pneumatic systems, or any other system that can apply forces to the system.

Fig – 3: Actuator of Robot[3]

Sensors:

The sensors are used as a converter that measures a physical quantity and converts it into a signal which can be read by an observer. The Sensors which are used in a robot are vision sensors (Camera), tactile and proximity sensors line sensors, Temperature sensors, light sensors and sound sensors.

Fig – 4: Sensor of Robot[4]

3. Types of Industrial Robots

Articulated - This robot design features rotary joints and can range from simple two joint structures to 10 or more joints. The arm is connected to the base with a twisting joint. The links in the arm are connected by rotary joints. Each joint is called an axis and provides an additional degree of freedom, or range of motion. Industrial robots commonly have four or six axes.

Fig – 5: Articulated Robot[5]

Cartesian - These are also called rectilinear or gantry robots. Cartesian robots have three linear joints that use the Cartesian coordinate system (X, Y, and Z). They also may have an attached wrist to allow for rotational movement. The three prismatic joints deliver a linear motion along the axis.

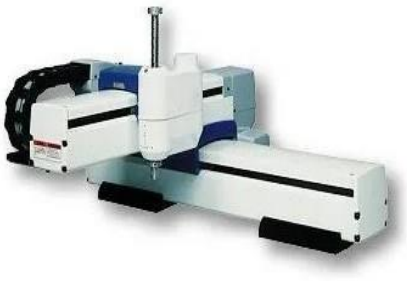


Fig – 6: Cartesian Robot[6]

Cylindrical - The robot has at least one rotary joint at the base and at least one prismatic joint to connect the links. The rotary joint uses a rotational motion along the joint axis, while the prismatic joint moves in a linear motion. Cylindrical robots operate within a cylindrical-shaped work envelope.

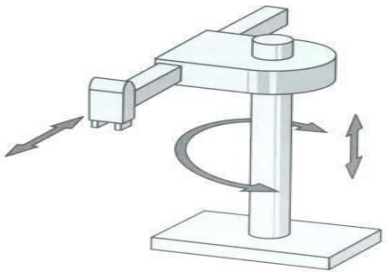


Fig – 7: Cylindrical Robot[7]

Polar - Also called spherical robots, in this configuration the arm is connected to the base with a twisting joint and a combination of two rotary joints and one linear joint. The axes form a polar coordinate system and create a spherical- shaped work envelope.

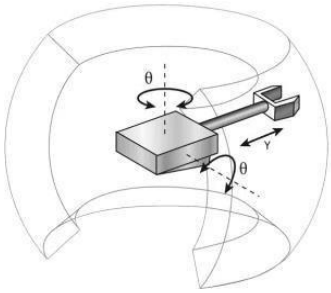


Fig – 8: Polar Robot

SCARA - Commonly used in assembly applications, this selectively compliant arm for robotic assembly is primarily cylindrical in design. It features two parallel joints that provide compliance in one selected plane.

Fig – 9: SCARA Robot

Delta - These spider-like robots are built from jointed parallelograms connected to a common base. The parallelograms move a single EOAT in a dome-shaped work area. Heavily used in the food, pharmaceutical, and electronic industries, this robot configuration is capable of delicate, precise movement.

Fig – 10: Delta Robot

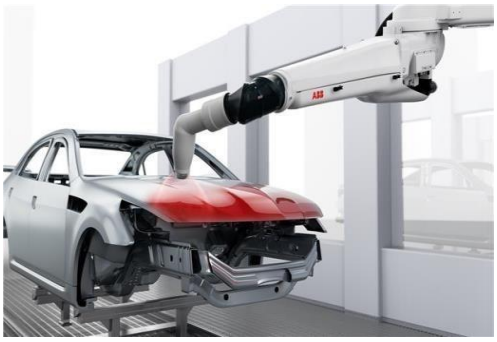
4. Applications:-

Robotic Assembly:- In many automotive plants, robots are assembling smaller components like pumps and motors at high speeds. Often, robots are performing tasks like windshield installation and wheel mounting to increase throughput.

Robotic Welding:- Robotic welding has been the top robotic application in the automotive sector for a long time, as every car needs a high number of welds before it's complete. Given the high value of the finished product, productivity from automation is enormous.

Robotic Painting:- Professional painters are difficult to find and the job is a highly toxic one. This makes it perfect

for robots, because the paint job needs to be highly consistent over a large area of paint, and reducing the amount of wasted material can add up to quite a bit of savings over time.



Material Removal:- High consistency and repeatability make robots perfect for material removal processes like trimming and cutting. This could be in the form of cutting fabrics, trimming plastic moldings and die castings or even polishing molds.

5. Advantages:-

1. Increased Efficiency
2. Higher Quality of Work
3. Increased Profitability
4. Improved Working Environment
5. Longer Working Hours

6. Limitations:-

1. Robots are Expensive
2. Maintenance cost is high
3. Skilled workers are required

7. Conclusion:-

Technological advancement in robotics has ever increasing need and contribution in the productivity, safety, efficiency, quality, and consistency of products. This increasing robotic advancement trend is not only associated with the revolution in robotics and automation but also human safety in a radioactive environment. Robots are used under extreme conditions on offshore oil and gas installation and nuclear radioactive environment.

8. References:-

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