e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

IMPORTANCE OF ROBOTIC TECHNOLOGY IN DIFFERENT FIELDS

Sahil Dilip Yadav*1, Prof. Chetan Bundele*2

*1Student, Department of Mechanical Engineering, Prof Ram Meghe Institute of Technology & Research (PRMITR), Badnera, India.

*2Assistant Professor , Department of Mechanical Engineering, Prof Ram Meghe Institute of Technology & Research (PRMITR), Badnera, India.

ABSTRACT

Robotics is a science and study of robots & an interdisciplinary field that integrates engineering science & engineering. Robotics may be a fascinating new field of study, & can efficiently growing one, as robots, are being employed more & more in various fields, including industry, research laboratories, and even in the house. Robots are most useful in places and situations where it's dangerous & risky for the human to figure, like nuclear power plants, diffusing bombs or working in mines. Besides, it is regularly less expensive and simpler to utilize robots as opposed to humans, especially for a certain position. This paper exhaustively confers about the classification of the robot, principle parts of the robots, and the application of robotic technology in the present world to succeed in the stage where the industries will have less human interference. Also, importance is given to understanding the essential design and methodology of the robot.

Keywords:- Robots, Industrial Robots, Medical, Robot Radioactive Environment.

I. INTRODUCTION

Although robotics as science was only developed in the twentieth century, the history of robots and human-invented automation has a considerably longer history. Indeed, the ancient Greek engineer Hero of Alexandria wrote two works, Pneumatica and Automata, which attest to the existence of hundreds of various types of "wonder" devices capable of automatic movement. Of course, the evolution of robots in recent years has been fascinating. Then what was the origin of the term "robot"? In his 1941, fiction story "Liar!" by science fiction novelist Isaac Asimov unknowingly came up with the term robotics. Science fiction authors have been fascinated by man's potential to create self-motivating machines and lifeforms. A robot is essentially a reprogrammable mechanism capable of movement in the execution of a task. Robots have unique code that distinguishes them from other machines and machine tools, such as CNC. Due to their sturdy resistance capabilities and precision function, robots have found applications in a wide range of industries. Simple automatons were created by the ancient Greeks and Romans for use as tools, toys, and in religious ceremonies. Predating modern industrial robots, the Greek God Hephaestus was said to have developed automatons to serve him in a workshop. Regrettably, none of the early automatons survive. Automatons were common in the Middle Ages in both Europe and the Middle East as elements of clocks and religious events. Al-Jazari (1136-1206), an Arab polymath, left manuscripts detailing and demonstrating his mechanical gadgets, which included a huge elephant clock that moved and sounded at the hour, a musical robot band, and a waitress automaton that served drinks. Many additional automata depicting moving animals and humanoid figures that ran on simple cam systems were built, but by the 18th century, automata had become well understood and technology had improved to the point where much more intricate pieces could be built. The first successful biomechanical automaton, a human figure playing the flute, is credited to French engineer Jacques de Vaucanson. With the arrival of the Roomba robotic cleaner in 2003, robots started working in households. By 2009, autonomous industrial vehicles were well on their way, and robotic arms were becoming mobile in the industrial area by the turn of the decade. Collaborative robots, or COBOTS, were established in 2013, and they are intended to operate with humans. AMRs, or Autonomous Mobile Robots, were working in warehouses by the following year. Omron Electronics purchased Adept Technologies in 2015, a firm with origins in Unimation, the first robot manufacturer. Throughout the rest of the decade, similar large purchases would occur. Robots have found a home in a variety of fields during the previous half-century, involving toys and entertainment, military weaponry, search and rescue aids, and a variety of other roles. Essentially, as programming and technology advance, robots will be able to perform many tasks that were previously too dangerous, monotonous, or difficult for people to complete.

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II. CLASSIFICATION OF ROBOTS

Based on the degree of movement, there are two basic categories of robots:

Fixed – robots do not move with respect to specific aspects of their surroundings.

Mobile - Robots can move about their surroundings utilizing a variety of locomotion techniques.

Fixed robots are ones that are fixed to a point and execute tasks with manipulators such as arms. Fixed robots are used in manufacturing, where they are employed for a number of functions including spray painting, welding, assembling, and quality check.

Fig.1. Assembly Line Robots
Courtesy : Robotsdoneright.com

Fig.2. Assembly Line Robots
Courtesy : Robotsdoneright.com

Mobile robots are becoming increasingly widespread. Robotics and computer science engineering are commonly regarded to be subfields of mobile robotics. Mobile robots could move from one location to other using wheels, legs, or crawling. Mobile robots transfer items from one location to another in hospitals and warehouses. Robotics research is an interdisciplinary field that includes sensors, remote controllers, and automation.

Fig.3. Mobile robot
Courtesy : Roboticsistem

Fig.4. DJI RoboMaster S1 Mobile Robot.
Courtesy : Generationrobots.com

III. COMPONENTS OF A ROBOT

A robot is composed of following main elements or components**:**

- **Control System**
- **Power Supply**
- **Arm**
- **Actuators**
- **End Effectors**
- **Sensor**

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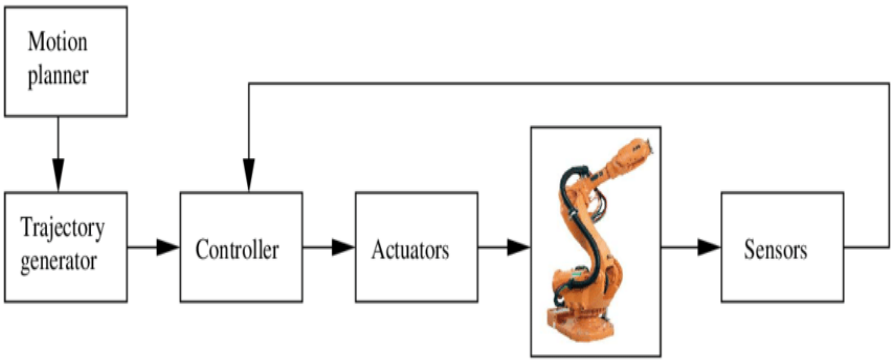

Fig.5. Block diagram showing components in the robot control problem

Courtesy : researchgate.net

1. CONTROL SYSTEM :-

Humans and other creatures, at their most basic level, rely on a concept known as feedback to live. Humans are aware of their surroundings and react appropriately. The control system of a robot employs feedback in the same way that the human brain does. A robot's brain, on the other hand, is made up of a silicon chip called a central processing unit, or CPU, which is comparable to the chip that operates your computer. Based on data from our five senses, our brains decide what to do and how to react to the world. The CPU of a robot accomplishes the same thing, using data acquired by sensors.

2. POWER SUPPLY :-

Power is required for a robot to function. Food is the source of energy for humans. Our cells break down and transform the food we eat into energy after we eat it. The majority of robots are powered by electricity. Stationary robotic arms, such as those used in auto plants, maybe plugged in just like any other device. Batteries are commonly used to power robots that move around. Solar electricity is frequently collected by our robotic space probes and satellites.

3. ARM :-

A robot's arm is a key component of its robotic architecture. The majority of robotic arms have fingers, wrists, and elbows, just like human hands. The arms are controlled by a servo motor. A serial robot arm is made up of a series of links that are moved by joints controlled by motors. An end-effector, often known as a robot hand, can be connected to the chain's end. Robot arms, like other robotic devices, are usually characterized by the number of degrees of freedom they have.

4. ACTUATORS :-

A device must have a body that can move in response to inputs from its sensors to be designated a robot. Metal, plastic, and other comparable materials are used to construct robot bodies. Actuators, which are miniature motors, are found inside these bodies. To move sections of the robot's body, actuators imitate the motion of the human muscle. The most basic robots are just an arm with a tool attached for a specific purpose. Robots with more sophisticated capabilities may be able to move about on wheels or treads. Humanoid robots have arms and legs that move in the same way as humans do.

5. END EFFECTORS :-

Robots are connected with end effectors, which allow them to interact with their surroundings and complete tasks. These differ depending on the tasks that the robot was created to perform. Paint sprayers and welding torches, for example, are interchangeable equipment for robotic manufacturing employees. Universal grippers, which imitate the function of the human hand, are commonly seen on mobile robots such as probes sent to distant planets or bomb disposal robots.

6. SENSORS :-

The sensors function as a converter, converting a physical quantity into a signal that can be interpreted by an observer. Vision sensors (camera), touch and proximity sensors, line sensors, temperature sensors, light sensors, and sound sensors are all utilized in robots. Sensors that replicate human senses, such as video cameras or light-dependent resistors that act as eyes or microphones that behave as ears, provide input to

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robots. Touch, taste, and smell are all senses that some robots have. The CPU of the robot reads the inputs from these sensors and modifies its actions accordingly.

IV. ADVANTAGES OF ROBOT

- Robots can improve product production, efficiency, quality, and consistency in a variety of settings.
- They may be extremely precise, down to fractions of an inch (example in the manufacturing of microelectronics)
- Robots can operate in hazardous situations, such as those found in the nuclear and chemical industries.
- Humans have different environmental requirements than robots, such as lighting, air conditioning, and noise reduction.

V. APPLICATION OF ROBOT

Robots now execute a variety of duties in a variety of sectors, and the number of work outsourced to robots is steadily increasing. The easiest method to categorize robots is to divide them into kinds based on their applications.

1. Industrial robots :-

Industrial robots are used in an industrialized production environment. Typically, these are articulated arms designed for material handling, painting, welding, and other uses. If we only consider the application, this type of robot might potentially include certain autonomously guided autos and other robots. It is used for a range of jobs, including component assembly, material handling, and inspection procedures. Robots are commonly used for welding, painting, assembling, and dismantling. Delta Robots, Unimate Robots, SCARA Robots, Cartesian Co-ordinate Robots, and other industrial robots are the most often adopted. The transportation of material or pieces from one area to another is the focus of Delta Robots. Part placement, palletizing and/or de-palletizing, and machine loading and unloading are some examples. Unimate Robots are used in the automobile industry to assemble parts. The SCARA Robot is used in the material handling industry.

Fig.6. Factory Automation with industrial robots for palletizing **food products like bread and toast at a bakery in Germany**

Courtesy : commons.wikimedia.org

Fig.7. Automation Industry Concept

Courtesy : internetofbusiness.com

2. Household or domestic robots :-

These are robots that are utilized in the home. Robotic pool cleaners, robotic sweepers, robotic vacuum cleaners, robotic sewer cleaners, and other robots that can do various domestic jobs are all examples of this type of robot. Several inspection and telepresence robots can also be classified as domestic robots when used in that context. A domestic robot is a sort of service robot, an autonomous robot that does home tasks but may also be used for teaching, amusement, or rehabilitation. While the majority of domestic robots are simple, others are connected to WiFi home networks or smart surroundings and are very independent.

Fig.8. Domestic robot

Courtesy : verdict.co.uk

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3. Medical robots :-

Robots used in medical and research facilities. Surgical treatment robots are first and foremost. There are also various robotically controlled autos and maybe lifting supports. Medical robots are driving a therapeutic paradigm change. The most widely used surgical robot, Intuitive Surgical's da Vinci system, has been discussed in over 4,000 peer-reviewed publications, has been cleared by the US Food and Drug Administration for multiple categories of operations, and was used in 80 percent of radical prostatectomies performed in the United States in 2008, just nine years after it was introduced. A combination of technology advancements (motors, materials, and control theory), breakthroughs in medical imaging (better resolutions, magnetic resonance imaging, and 3D ultrasound), and a rise in surgeon/patent numbers are driving the rapid rise of medical robotics.

Fig.9. Medical robotics in China

Courtesy : Nature.com

4. Military robotics :-

They are used in the military and armed forces. Bomb-disposing robots, different delivery robots, and exploration drones are examples of this type of robot. Robots that were originally developed for military and armed forces reasons are frequently used in law enforcement, exploration and salvage, and other related industries.

Fig.10. The Titan unmanned modular ground vehicle developed by QinetiQ North America and Milrem Robotics.

Courtesy : roboticsbusinessreview.com

5. Space robots :-

Spacecraft robotic arms are used to move huge & heavy things in spacecraft. The robots interpret and complete the task themselves, the orders supplied by the researchers. They give directives to them. This robot class comprises the lunar rovers exploring the Martian surface. This sort of robot would include the Canadarm robots that were used in space Shuttles and the International Space Station, as well as Mars explorers and other robots used in space exploration and other operations. Microgravity and Planetary Robotics are the two primary areas of interest for the Space Robotics Technical Committee. Microgravity Robotics encompasses manipulation and movement for applications such as ISS operations and satellite maintenance. Using manipulation or movement on or near the surface, planetary robot systems handle scenarios such as Mars and lunar exploration. Asteroid and comet exploration scenarios, for example, may feature settings with low gravity, blurring the lines between these groups.

Fig.11. Robots in space

Courtesy : online-sciences.com

6. Humanoid Robots :-

Humanoid robots are quite popular since they resemble people. Sophia is the world's first artificially intelligent humanoid robot. Hanson robots presented Sophia to the United Nations on October 11, 2017, and she can do a wide range of human tasks. Her Artificial Intelligence is based on human ideals, and she has incredibly expressive eyes. She has a similar sense of humor to me. This humanoid was created to resemble Audrey Hepburn, the late British actress. Sophia has been in several interviews and conferences and is currently one of the most well-known humanoids on the planet. Sophia spoke on robot rights at the Australian Engineering Conference.

Fig12. Sophia in 2018

Courtesy : en.wikipedia.org/wiki/Sophia_(robot)

VI. CONCLUSION

In conclusion, robotic technology has had a significant influence on the globe in a variety of ways. Robotic technology is quickly advancing in the twenty-first century. The benefits of employing robotics have been recognized to the point that they have become a part of our daily life. In markets, hospitals, homes, the workplace, even on the battlefield, robotic technology may be found. Robotics is frequently employed to perform tasks that people might do. In other words, there are a variety of reasons why robots may be superior to humans in specific activities. We utilize robots to complete jobs because they are faster than humans. Robots can also work in hazardous environments where humans cannot. Humans cannot resist as much heat, radiation, chemical vapors, or other risks as robots can. They are capable of performing repeated jobs that humans may find tedious. Robotics provides efficiency by allowing them to do tasks without wasting time, effort, energy, or resources. Furthermore, robots provide precision in the assembly of parts and the execution of complicated tasks. Furthermore, robotics provides versatility by allowing it to do several tasks. Robotic technologies provide the world with many applications and efficient methods for completing several tasks. We have discovered methods to make our lives more convenient, safeguard lives, enhance product productivity, and conduct research thanks to advancements in robotic technology. Technological innovation in robotics has created an ever-increasing demand for and contribution to product productivity, safety, efficiency, quality, and consistency. This rising trend in robotic improvement is linked not only to the revolution in robotics and

automation but also to human safety in a radioactive environment. Robots are utilized in harsh environments like offshore oil and gas installations and nuclear power plants.

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