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A Review on Robotics Technology and Its Applications

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Abstract: The introduction of new creations greatly accelerates technological development. One such invention to lessen the current labour cost difficulties is the robot. It is an intermediate field with a scope that includes computer science, mechanical, electrical, and electronic design. These days, robots assist humans in numerous areas, making life easier and delivering goods more quickly than humans could. The science and technology of robotics are introduced in this review paper. We present the background of robotics technology, science, the components used in robot manufacture, the construction of robots, their benefits and drawbacks, and their applications.
Keyword: Artificial Intelligence, Automation, Sensors, Machine Learning, Mechatronics, Computer Vision

1. Introduction About Robotics

The word robotics is derived from the word robot, which was first used by Czech playwright Karl Capek. Automation is an engineering field that combines various engineering specialties, including electronics, mechanical, computer, and electrical engineering. A whole robot is constructed from numerous parts. These components of a robot consist of a sensor that is connected to the electronics stream, many wires for each tool's power source that are connected to the electrical stream, and electrical components such stepper motors. A computer engineer's coded chip functions as the artificial intelligence system's brain. While the promise of robotics is clear, it may be mentally challenging.

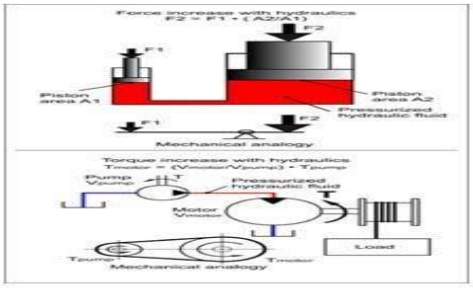
The robot could alternatively be referred to as "artificial intelligence."

2. Fundamentals of robotics

Following is a brief description of each component of the robot system.

1. Controller: A robot's controller is the component that manages all of the mechanical system's movements and gathers input from its surroundings using a variety of sensors.

2. Power Supply: The energy needed to run the controllers is supplied by the power supply. It could be a pump or compressor that provides hydraulic or pneumatic power, or it could be a converter that changes the ac voltage to the dc voltage needed by the robot's internal circuits. Pneumatic, hydraulic, and electrical power supplies are the three main categories. The most widely used energy source is electricity, which is produced by industrial robots. The least common is hydraulic power, and compressed air is the second most common.
3. Hydraulic Drive: A hydraulic drive system is a transmission or drive those powers hydraulic machinery with pressurized hydraulic fluid. The transfer of energy from flow and pressure—rather than from the kinetic energy of the flow—is referred to as hydrostatic. A power unit



principle of hydraulic drive system

4. Electric Motors: Most robots run on electric motors, which are commonly AC motors in industrial robots and CNC machines or brushed and brushless DC motors in portable robots. These motors are frequently chosen for systems with lower loads and rotation as the primary mode of motion.
5. Linear Actuator: There are several kinds of linear actuators that move in and out rather than spin, and they frequently have quicker direction changes. These actuators are especially useful in situations requiring very large forces, like in industrial robotics.
6. Sensing: - Robots can obtain data from sensors regarding a particular measurement of their surroundings or internal parts. This is necessary for robots to accomplish their tasks and react appropriately to changes in their surroundings.

3. Application

3.1 Space Robotics:

- Developing intelligent robots for extraterrestrial exploration is the focus of this research area, which focuses on the following: Developing robot systems for unstructured, uneven terrain based on creative locomotion concepts inspired by biology.
- The creation of multipurpose robot teams that can be used for everything from in-situ inspections to infrastructure organization and upkeep.

- Systems that can be reconfigured for space exploration.
- AI-driven techniques for self-navigating and planning missions in uncharted territory.

Space Robotics

3.2 Agricultural Robotics

We create robots for use in agriculture and apply robotics techniques and algorithms to standard agricultural machinery. Our goal is to simultaneously decrease resource consumption and improve machine and process performance. The use of technology in land cultivation is the main topic of our research.

For Agricultrual Use

- Methods for autonomous planning and navigation of outdoor machinery.
- Methods for environmental recognition in agricultural machinery control.
- Methods of infield logistics to optimize cooperation and resource consumption between multiple agricultural machines.

4. Discussion

1. Technological Advancements: Conversations often revolve around the latest developments in robotics, including breakthroughs in AI, machine learning, sensor technology, and the integration of these advancements into robots for various applications.
2. Ethical Considerations: The ethical implications of robotics and AI are a significant part of discussions. These conversations address issues like job displacement due to automation, the ethical use of robots in warfare, the rights of AI, and the ethical responsibilities of developers and users.
3. Impact on Employment and Society: Robotics has the potential to significantly impact the job market and various industries. Discussions often focus on how automation might affect employment and how society can adapt to these changes.
4. AI and Safety: Conversations often delve into the safety aspects of AI-powered robots, addressing concerns about autonomous decision-making, potential risks, and the responsibility for the actions of intelligent machines.

5. Robotics in Healthcare: Discussions often revolve around the advancements in medical robotics, such as surgical robots, exoskeletons for rehabilitation, and the potential impact on healthcare delivery and patient outcomes.
6. Convolutional Neural Networks (CNNs): A specific type of neural network architecture primarily used for analysing visual data. CNNs are particularly effective for tasks like image classification and object detection.
7. Semantic Segmentation: The process of partitioning an image into different segments and assigning semantic meaning to each part (e.g., identifying objects and their boundaries).
8. Optical Character Recognition (OCR): The technology for recognizing and extracting text from images or scanned documents.
9. Facial Recognition: Identifying or verifying individuals by analysing and comparing patterns in facial features.
10. Motion Analysis: Understanding and interpreting motion within a sequence of images or video frames.
11. Feature Matching: Comparing and matching visual features between images for tasks such as image stitching, object tracking, and registration.
12. Camera Calibration: The process of determining the parameters of a camera, like its focal length, distortions, and perspective, to facilitate accurate measurements from images.
13. Edge Detection: Identifying points in an image where the brightness changes significantly, often indicating the presence of an object boundary.
14. Image Restoration: Techniques used to enhance or recover the original image from corrupted or degraded versions.
15. Stereo Vision: Using two or more cameras to extract 3D information from the disparity between their viewpoints.

These keywords form the foundation of concepts and techniques used in computer vision, enabling computers to understand and interpret visual information, which has broad applications across various industries and fields.

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