



A.V.C COLLEGE OF ENGINEERING
DEPARTMENT OF COMPUTER APPLICATIONS
(A Recognized as a Research Centre
Approved by Anna University, Chennai)



"CAS Newsletter"

Volume : 27

MONTH: Dec ' 25

Issue : 1

A Natural User interface (NUI) is a system for human-computer interaction that the user operates through intuitive actions related to natural, everyday human behavior. A NUI may be operated in a number of different ways, depending on the purpose and user requirements.

This is the emerging field in computer science. I encourage all the students to know about this kind of new technologies.

This article is very much useful to about the methodologies involved in NUI.

Wish you All Success...!!

Dr.S.SELVAMUTHUKUMARA

LEARNER WRITER:

1st-MCA

C.V.MAHASRI

S.KAMATCHI

THE RISE OF PHYSICAL AI

ABSTRACT:

Physical Artificial Intelligence (Physical AI) represents the integration of artificial intelligence with embodied robotic systems capable of interacting with the physical world. Unlike traditional software-based AI, Physical AI combines perception, cognition, and action within real-world environments. This assignment explores the rise of Physical AI and robotics through twenty key subtopics, examining technological foundations, applications, challenges, and long-term societal implications.

INTRODUCTION:

Physical Artificial Intelligence refers to AI systems that are embedded in physical machines, allowing them to interact with the real world. Unlike traditional AI that operates only in software, Physical AI enables machines to sense their environment, make decisions, and perform physical actions. This marks a major shift from digital intelligence to embodied intelligence.

MEANING OF PHYSICAL AI:

Physical AI refers to artificial intelligence systems embedded in physical entities such as robots, autonomous vehicles, drones, and intelligent machines. These systems continuously collect data from the environment, process it using AI algorithms, and respond through physical actions. Physical AI must work under real-world constraints like time, space, energy, and safety.

1. Core Architecture of Physical AI Systems:

A Physical AI system consists of several core components: sensors, perception systems, decision-making algorithms, actuators, and control mechanisms. Sensors collect real-time data from the environment, perception systems interpret this data, AI algorithms decide on the appropriate action, and actuators execute physical movements. This closed-loop architecture allows continuous interaction between the machine and its environment.

2. Role of Machine Learning in Physical AI:

Machine learning plays a crucial role in enabling Physical AI systems to learn from experience rather than relying only on predefined rules. Through training on large datasets and real-world interactions, machines can improve their performance over time. Reinforcement learning allows systems to learn optimal actions through trial and error, which is essential for tasks such as navigation, manipulation, and balance.

3. Perception through Sensors and Computer Vision:

Perception is fundamental to Physical AI. Sensors such as cameras, LiDAR, radar, ultrasonic sensors, and force sensors provide information about the environment. Computer vision enables machines to recognize objects, understand spatial relationships, and detect obstacles. Accurate perception allows Physical AI systems to operate safely and efficiently in dynamic environments.

4. Physical AI in Robotics:

Robotics is the most visible application of Physical AI. AI-powered robots can perform complex tasks such as walking, grasping objects, and collaborating with humans. Physical AI enables robots to adapt to changing environments, learn new tasks, and respond intelligently to human input. This has expanded the use of robots beyond factories into homes, hospitals, and public spaces.

5. Applications of Physical AI Across Industries:

Physical AI is widely used in manufacturing, healthcare, transportation, agriculture, and service industries. In manufacturing, AI-driven robots improve productivity and precision. In healthcare, Physical AI assists in surgery and rehabilitation. Autonomous vehicles and drones rely on Physical AI for navigation and decision-making. These applications demonstrate the broad impact of Physical AI on modern society.

6. Human–Machine Interaction in Physical AI:

Human–machine interaction is a key aspect of Physical AI. Modern

systems are designed to communicate with humans through speech, gestures, and intelligent responses. Safe and natural interaction is essential for collaborative environments where humans and machines work together. Physical AI systems are increasingly designed to understand human behavior and intentions.

7. Ethical, Social, and Safety Considerations:

The rise of Physical AI raises important ethical and social concerns. Issues

such as job displacement, privacy, safety, and accountability must be carefully addressed. Since Physical AI systems operate autonomously in real-world environments, ensuring transparency, fairness, and safety is critical to gaining public trust and acceptance.

8. Future Scope and Conclusion

The future of Physical AI includes advancements such as humanoid robots, autonomous systems, soft robotics, and AI-powered assistive devices. As technology continues to evolve, Physical AI will become more adaptive, intelligent, and integrated into daily life. In conclusion, the rise of Physical AI marks a significant technological transformation, enabling intelligent machines to interact with the physical world while improving efficiency, safety, and quality of life.

THE RISE OF ROBOTICS

Ist-MCA

G.HARITHRA

K.JEEVA DHARSHINI

INTRODUCTION TO ROBOTICS:

Robotics is the interdisciplinary field that designs, builds, and operates robots—machines capable of performing tasks autonomously or semi-autonomously. The rise of robotics is a result of advances in mechanics,

electronics, computing, and artificial intelligence. Modern robots are no longer limited to factories; they are used in healthcare, transportation, space exploration, agriculture, and domestic services.

History and Evolution of Robotics

Robotics has evolved from simple mechanical automata in ancient times to industrial robots in the 20th century, and now to intelligent, AI-powered systems. Early robots were programmed to perform repetitive tasks. The introduction of computers, sensors, and actuators allowed robots to adapt, perceive, and make decisions. Today, robotics is driven by AI, machine learning, and cloud connectivity, enabling autonomous decision-making and interaction.

MEANING OF ROBOTICS:

Robotics is the branch of science and technology that deals with the design, construction, operation, and application of robots. It combines principles from mechanical engineering, electronics, computer science, and artificial intelligence to create machines capable of performing tasks autonomously or semi-autonomously.

In simple terms, robotics involves creating machines that can sense the environment, process information, and take actions to accomplish specific tasks, often replacing or assisting humans in areas such as manufacturing, healthcare, exploration, and daily life.

1. Core Architecture of Robotics:

The core architecture of robotics refers to the fundamental structure and components that enable a robot to sense, process, and act in its environment. A robot is not just a machine; it is a system that integrates multiple subsystems to function autonomously or semi-autonomously. The core architecture typically consists of four main components:

a) Sensors

Sensors act as the sensory organs of a robot. They allow the robot to perceive the environment and collect data.

- **Examples:** Cameras (vision), LiDAR (distance measurement), ultrasonic sensors (obstacle detection), force sensors (pressure), gyroscopes (orientation).
- **Purpose:** Provide real-time information so the robot can understand its surroundings, detect obstacles, and respond appropriately.

b) Controllers / Processing Unit (Brain of the Robot)

The controller is the “brain” of the robot. It receives data from sensors, processes it using algorithms, and sends instructions to actuators.

- **Examples:** Microcontrollers, embedded computers, AI processors.
- **Functions:** Decision-making, path planning, task scheduling, learning from experience (if AI or machine learning is integrated).

c) Actuators

Actuators are the muscles of the robot. They execute physical actions based on instructions from the controller.

- **Examples:** Electric motors, hydraulic pistons, pneumatic systems, servo motors.
- **Purpose:** Enable movement, manipulation, gripping, rotation, or any physical task.

d) Power Supply

The power system provides the necessary energy for the robot to operate.

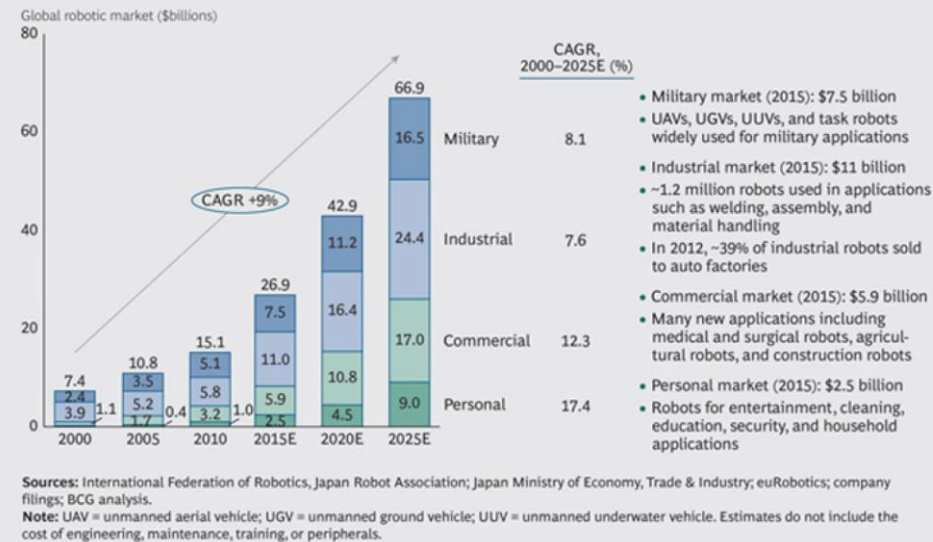
- **Examples:** Batteries, solar panels, electric lines, fuel cells.
- **Purpose:** Ensures uninterrupted operation of sensors, controllers, and actuators.

2. Types of Robots:

Robots can be classified based on their applications and mobility:

- **Industrial Robots** – used in factories for assembly, welding, and painting.
- **Service Robots** – assist humans in homes, hospitals, and offices.
- **Medical Robots** – surgical, rehabilitation, and prosthetic systems.
- **Autonomous Vehicles and Drones** – self-driving cars and aerial drones.
- **Humanoid Robots** – designed to mimic human behavior and interaction.

EXHIBIT 1 | Worldwide Spending on Robotics Is Expected to Reach \$67 Billion by 2025



3. Robotics and Artificial Intelligence:

AI is a key driver in modern robotics. By integrating AI, robots can perceive environments, make intelligent decisions, and learn from experience. Machine learning allows robots to improve performance over time, while deep learning enables advanced perception through vision and speech recognition.

4. Industrial and Manufacturing Applications:

The rise of robotics transformed manufacturing through automation. Robots perform repetitive, dangerous, or precise tasks with high speed and accuracy. Smart factories integrate robotics with IoT and AI, enabling efficient production, predictive maintenance, and quality control. Collaborative robots (cobots) now work alongside humans safely.

5. Healthcare and Medical Robotics:

Robotics has revolutionized healthcare by enhancing precision, reducing

human error, and improving patient care. Surgical robots allow minimally invasive operations, while rehabilitation robots help patients recover mobility. Robotic prosthetics and exoskeletons restore physical function and independence.

6. Autonomous Transportation and Drones:

Robots are key in modern autonomous transportation. Self-driving cars, delivery drones, and logistic robots rely on AI for navigation, obstacle detection, and real-time decision-making. Robotics improves safety, reduces labor costs, and optimizes transport efficiency.

7. Social and Human-Robot Interaction:

As robots enter daily life, effective human-robot interaction (HRI) becomes essential. Robots use speech, gestures, and AI algorithms to communicate and collaborate safely with humans. Ethical and social considerations guide the design to ensure trust, safety, and acceptance in society.

8.Future Scope of Robotics:

The future of robotics includes humanoid AI robots, swarm robotics, soft robotics, and bio-inspired machines. Integration with Physical AI, IoT, and cloud computing will make robots more autonomous, intelligent, and adaptable to human environments. Robotics will continue to impact industries, healthcare, transport, and daily life, shaping the future of technology.

Conclusion: The Rise of Robotics:

The rise of robotics represents a transformative shift in technology, combining mechanics, electronics, and artificial intelligence to create machines capable of performing tasks autonomously or semi-autonomously. From early mechanical automata to modern AI-powered robots, robotics has evolved to impact industries, healthcare, transportation, agriculture, and daily life.

Robots today not only perform repetitive and dangerous tasks with high precision but also collaborate safely with humans, making processes more efficient, productive, and reliable. The integration of AI, machine learning, and advanced sensors has enabled robots to perceive their environment, make intelligent decisions, and learn from experience, extending their capabilities beyond traditional automation.

While robotics offers immense benefits, it also raises ethical, social, and economic considerations, including job displacement, privacy, and safety concerns. Responsible development, human–robot interaction, and ethical guidelines are essential to maximize benefits while minimizing risks.

Looking ahead, the future of robotics promises **humanoid robots, swarm robotics, soft robotics, autonomous vehicles, and AI-driven assistive systems**, which will increasingly integrate into human life, enhancing efficiency, safety, and quality of life across multiple sectors.

In essence, the rise of robotics marks the dawn of an era where intelligent machines work alongside humans, transforming the way we live, work, and interact with technology.