# CHAPTER 2

NEW AGE ROBOTICS SYSTEMS

Learning Outcomes

- Introduction to New Age Robot
- Real World Applications
- Benefits of New Age Robotics Systems

New Age Robotic Systems use advanced technologies like Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT) to make robots smarter and more independent. Unlike older robots that followed fixed instructions, these modern robots can learn from experience, analyse data, and make their own decisions. For example, self-driving cars and drones use AI and sensors to move and operate on their own. Some robots, called cobots, work safely with humans in factories, hospitals, and homes to improve efficiency. IoT helps robots stay connected, get updates, and be controlled from anywhere. These robots are used in many areas, like performing surgeries, assisting in daily tasks, and managing warehouses, making life easier and work more efficient.
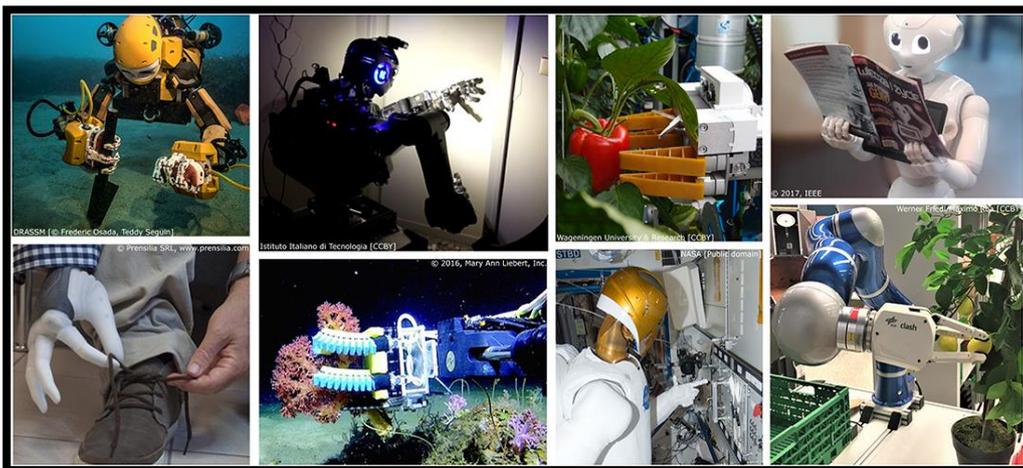
How Are New Age Robots Different?

New Age Robots are different from traditional robots because they are smarter, more adaptable, and capable of working in complex environments. Unlike older robots that followed pre-programmed instructions without flexibility, modern robots use Artificial Intelligence (AI),

Machine Learning (ML), and the Internet of Things (IoT) to learn, make decisions, and interact more naturally with their surroundings.

Key Differences between Traditional and New Age Robots

1. **Intelligence and Decision-Making**
   - **Traditional Robots:** Operate based on fixed programming and follow set instructions. They cannot change their actions based on new information.
   - **New Age Robots:** Use AI and ML to analyse data, recognize patterns, and make real-time decisions. They can improve their performance over time without needing manual reprogramming.

2. **Learning Ability**
   - **Traditional Robots:** Require human engineers to reprogram them for any changes or updates.
   - **New Age Robots:** Learn from experience using machine learning. They can adapt to new environments and tasks without requiring direct human intervention.

3. **Human Collaboration (Cobots)**
   - **Traditional Robots:** Mostly worked in isolated environments like factories, away from humans, to prevent accidents.
   - **New Age Robots:** Include **collaborative robots (cobots)** that work safely alongside humans in industries, hospitals, and homes. They can assist in tasks like assembling products, providing medical support, and even helping with household chores.

4. **Connectivity and IoT Integration**
   - **Traditional Robots:** Function independently and do not connect to networks or other devices.
   - **New Age Robots:** Use **IoT** to communicate with other machines, update their software remotely, and operate from anywhere via the internet. This makes them highly efficient in industries like logistics, where robots in warehouses can communicate with supply chain systems.

5. **Autonomy and Mobility**
   - **Traditional Robots:** Were mostly stationary or moved in controlled environments with limited flexibility.
   - **New Age Robots:** Have **autonomous navigation** capabilities. For example, self-driving cars and delivery drones use AI, GPS, and sensors to move safely without human control.

6. **Advanced Sensing and Perception**
   - **Traditional Robots:** Had limited sensors and could only perform basic tasks.
   - **New Age Robots:** Use advanced **computer vision, LiDAR, ultrasonic sensors, and AI-powered cameras** to detect objects, recognize faces, and interact with their environment more naturally.

7. **Application Areas**
- **Traditional Robots:** Mostly used in manufacturing, where they performed repetitive tasks like assembling cars.
- **New Age Robots:** Are used in a variety of fields, including:
  - **Healthcare:** Assisting in surgeries, delivering medicines, and helping elderly patients.
  - **Education:** Teaching students using interactive AI-based robots.
  - **Agriculture:** Monitoring crops, planting seeds, and automating harvesting.
  - **Smart Homes:** Cleaning, assisting with daily tasks, and improving home security.

Applications of New Age Robotics Systems

New Age Robotics Systems are being used in many areas to make work easier, faster, and more efficient. These robots are smarter than traditional robots because they use **Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT)** to think, learn, and make decisions. They can work in factories, hospitals, homes, farms, and even space. Let's explore some important areas where these advanced robots are used.

1. Industry and Manufacturing

Modern robots are transforming the industry and manufacturing sector by improving productivity, accuracy, and workplace safety. Unlike traditional robots that followed fixed commands, today's robots use Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT) to make smart decisions, adapt to different tasks, and work alongside humans. These robots help in assembling products, handling heavy materials, inspecting quality, and speeding up production while reducing errors and costs.

One of the major advancements in manufacturing is the use of **Collaborative Robots (Cobots)**, which work alongside human workers without the need for safety barriers. These robots assist in tasks like lifting heavy parts, tightening bolts, and assembling components, making production safer and more efficient. Another key development is **Automated Assembly Lines**, where robotic arms are used for welding, painting, and assembling products such as cars, smartphones, and electronic devices with high precision and speed. This ensures consistent product quality and reduces manufacturing defects. Quality control has also improved with **AI-powered robots**, which use cameras and sensors to inspect products for defects. These robots are widely used in the electronics, automobile, and food industries to

ensure high-quality standards. Additionally, **Material Handling Robots**, such as Automated Guided Vehicles (AGVs), help transport heavy goods in warehouses and factories, reducing human effort and preventing workplace injuries.

With the rise of **Industry 4.0 and smart manufacturing**, factories now use IoT-enabled robots and AI-driven systems to automate production and make real-time decisions. Companies like Siemens and General Electric use smart sensors to monitor machine performance and predict failures before they occur, improving efficiency and reducing downtime. Furthermore, robots are increasingly used in **hazardous environments** such as mining, oil rigs, and nuclear plants, where they perform dangerous tasks that would otherwise put human lives at risk.

2. Healthcare Robotics

Robots are changing healthcare by helping doctors, nurses, and patients in many ways. They make surgeries more precise, assist in daily medical tasks, take care of elderly people, and keep hospitals clean. With smart technology and automation, robots are making healthcare safer, faster, and more effective.

One of the most important uses of robots in healthcare is **surgical robots**. Robots like the **da Vinci Surgical System** help doctors perform surgeries with great accuracy. These robots have special arms controlled by surgeons, allowing them to make small cuts instead of large ones. This means less pain, less blood loss, and faster recovery for patients. They are used in surgeries for the heart, cancer treatments, and bone-related procedures.

Besides surgeries, robots also help in **medical assistance**. They deliver medicines, monitor patients' health, and support hospital staff. Robotic carts and automated systems ensure that patients get the right medicine on time. Some robots can even check a patient's heart rate, temperature, and other vital signs and inform doctors if there is a problem.

Robots are also useful in **elderly care**. Special robots assist older people with daily activities like taking medicines, walking, and even talking to them to reduce loneliness. Some robots, like **PARO**, are designed as robotic pets to give comfort and emotional support to seniors, especially those feeling lonely or stressed. Home assistant robots can also help with household chores, allowing elderly people to live on their own safely.

Another important area where robots are used is **sanitation and disinfection**. Hospitals use cleaning robots with UV lights or disinfectants to kill germs and viruses. These robots clean hospital rooms, operation theatres, and public areas, reducing the spread of infections. During

the COVID-19 pandemic, such robots played a big role in keeping hospitals safe by reducing human contact with infected areas.

With on-going improvements in technology, robots will continue to play a bigger role in healthcare. In the future, we may see more robots assisting in diagnosis, patient care, and even remote surgeries. These advancements will help make healthcare more efficient and accessible to people all over the world.

3. Autonomous Vehicles (Self-Driving Cars and Drones)

Autonomous vehicles, such as self-driving cars and drones, are a major part of modern robotic systems. These vehicles operate without human control by using advanced sensors, artificial intelligence (AI), and real-time decision-making. Self-driving cars rely on technologies like LiDAR, cameras, and radar to detect obstacles, recognize traffic signs, and navigate safely. AI processes this information to make driving decisions, such as stopping at signals, changing lanes, or avoiding collisions. Similarly, drones use GPS, sensors, and AI to fly independently, avoiding obstacles and tracking objects. They are widely used in areas like delivery services, agriculture, surveillance, disaster management, and even military applications. The biggest advantages of these systems include improved efficiency, reduced human errors, and enhanced safety. By automating transportation and logistics, they help in reducing accidents and increasing productivity. Many autonomous vehicles also run on electric power, making them environmentally friendly.

The Future of New Age Robotics

The future of robotics is exciting and will change the way we live and work. Robots are becoming **smarter, more independent, and capable of handling complex tasks** without much human help. From **self-driving cars and drones** to **smart homes, healthcare robots, and factory automation**, robots will play a bigger role in our daily lives.

What to Expect in the Future?

1. **Smarter Robots with AI**
   - Robots will **learn from experience**, make decisions on their own, and adapt to different situations.
   - They will understand speech, recognize objects, and interact with humans more naturally.
2. **Working with Humans**
   - **Cobots (collaborative robots)** will work alongside humans in factories, hospitals, and offices.
   - Robotic exoskeletons and prosthetics will help people with mobility issues.

3. **Self-Driving Cars and Drones**
   - Autonomous vehicles will make travel safer and reduce accidents.
   - Robots will be used for space exploration, disaster relief, and even deep-sea research.

4. **Smarter Homes and Cities**
   - AI-powered home assistants, cleaning robots, and security bots will make daily life easier.
   - Smart cities will use robots for **traffic management, waste disposal, and emergency response**.

5. **Robots in Healthcare**
   - Surgical robots will help doctors perform precise operations.
   - AI-powered diagnostic robots will help detect diseases early and improve medical care.

6. **Challenges and Responsibilities**
   - As robots become more advanced, we must **address issues like privacy, job loss, and ethical concerns**.
   - Cyber security will be important to **protect robots from hacking and misuse**.

Chapter Highlights

- New-age robots use Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT) to work on their own and adapt to different situations.
- They can understand data, learn from experience, and make decisions without human help.
- Unlike old robots, they don't just follow fixed instructions.
- They are more flexible, efficient, and can handle different tasks better.
- Old robots work only as programmed, but new-age robots can learn and improve over time.
- AI and ML help new-age robots get smarter with experience.
- Traditional robots need human updates, while new robots can update themselves by learning from data.
- Examples include self-driving cars that avoid obstacles, drones for delivery and rescue, and collaborative robots (cobots) that help in factories and hospitals.
- Smart home assistants learn what users like and automate tasks.
- In the future, better sensors, AI, and computing power will make robots even smarter and more independent.
- Robots will be connected to cloud computing and use AI to work faster and

Multiple Choice Questions (MCQs)

1. What makes New Age Robots different from traditional robots?
   a) They follow fixed programming
   b) They use AI, ML, and IoT to learn and adapt
   c) They can only work in factories
   d) They do not interact with humans

2. Which of the following is an example of a New Age Robot?
   a) A welding robot in a car factory
   b) A self-driving car using AI and sensors
   c) A mechanical arm with no sensors
   d) A calculator

3. How do New Age Robots assist in healthcare?
   a) By performing surgeries with AI assistance
   b) By replacing doctors completely
   c) By only providing medicines manually
   d) By avoiding interaction with patients

4. Which technology helps New Age Robots stay connected and update remotely?
   a) Artificial Intelligence (AI)
   b) Internet of Things (IoT)
   c) Machine Learning (ML)
   d) 3D Printing

5. What are cobots designed to do?
   a) Work in isolation without human assistance
   b) Work safely alongside humans
   c) Replace all human workers in industries
   d) Only work in space exploration

6. Which of the following industries benefits from New Age Robotics?
   a) Only automobile manufacturing
   b) Only education and healthcare
   c) Various industries, including agriculture, smart homes, and logistics
   d) Only military and defence

7. How do self-driving cars navigate independently?
   a) By using AI, sensors, and real-time decision-making
   b) By following pre-set routes with no adjustments
   c) By using only human input for directions
   d) By relying solely on GPS without any AI processing

8. Which type of robots help in elderly care by providing companionship and assistance?
   a) Industrial Robots
   b) Surgical Robots
   c) Assistive Robots
   d) Military Robots
9. What is the main advantage of AI-powered quality control robots in manufacturing?
   a) They eliminate all human jobs
   b) They help detect defects and improve product quality
   c) They only work in electronics factories
   d) They do not interact with other machines
10. In the future, robots are expected to:
    a) Completely replace human workers in all fields
    b) Work alongside humans and perform advanced tasks
    c) Become less intelligent and less useful
    d) Operate only in space exploration

Fill in the Blanks

1. _____ robots are designed to work safely alongside humans in various environments.
2. The Internet of Things (IoT) enables robots to stay _____ and receive remote updates.
3. Self-driving cars use AI, sensors, and _____ to navigate independently.
4. Surgical robots help doctors perform precise operations with minimal _____.
5. The main advantage of AI-powered robots in quality control is detecting _____ in products.

True & False [   ]

1. Traditional robots are more intelligent than New Age Robots.
2. IoT allows robots to be controlled and updated remotely.
3. Cobots are designed to replace human workers completely.
4. AI-powered robots help improve efficiency in manufacturing and healthcare.
5. Self-driving cars do not use any sensors for navigation.

Assertion-Reason Questions

1. **Assertion (A):** New Age Robots can adapt to new environments without manual reprogramming.
   Reason (R): Machine Learning enables robots to learn from experience and improve performance.
   a) Both A and R are true, and R is the correct explanation of A
   b) Both A and R are true, but R is not the correct explanation of A
   c) A is true, but R is false
   d) A is false, but R is true

2. **Assertion (A):** AI-powered quality control robots help detect product defects in factories.
   Reason (R): These robots use sensors and computer vision to analyze products.
   a) Both A and R are true, and R is the correct explanation of A
   b) Both A and R are true, but R is not the correct explanation of A
   c) A is true, but R is false
   d) A is false, but R is true
3. **Assertion (A):** Self-driving cars completely eliminate the need for human intervention.
   Reason (R): These vehicles rely entirely on GPS without using AI or sensors.
   a) Both A and R are true, and R is the correct explanation of A
   b) Both A and R are true, but R is not the correct explanation of A
   c) A is true, but R is false
   d) A is false, but R is true
4. **Assertion (A):** Robots are widely used in disaster management.
   Reason (R): Robots can enter dangerous areas to help with search and rescue operations.
   a) Both A and R are true, and R is the correct explanation of A
   b) Both A and R are true, but R is not the correct explanation of A
   c) A is true, but R is false
   d) A is false, but R is true
5. **Assertion (A):** Robots can replace all human jobs in industries.
   Reason (R): Robots are programmed to work exactly like humans in all tasks.
   a) Both A and R are true, and R is the correct explanation of A
   b) Both A and R are true, but R is not the correct explanation of A
   c) A is true, but R is false
   d) A is false, but R is true

Short Answer Questions

1. What are the key features that make New Age Robots different from traditional robots?
2. How does IoT help in the operation of modern robots?
3. What role do robots play in healthcare? Give two examples.
4. How do cobots contribute to improving efficiency in industries?
5. What are some of the challenges associated with the advancement of New Age Robots?

Long Answer Questions

1. Explain the differences between Traditional Robots and New Age Robots with suitable examples.
2. How do self-driving cars and drones function? Discuss the technologies they use.
3. Describe the role of AI, ML, and IoT in modern robotic systems and their impact on industries.
4. Discuss the various applications of robotics in healthcare and their benefits.
5. What does the future of robotics look like? Discuss key advancements and their potential impact on society.