

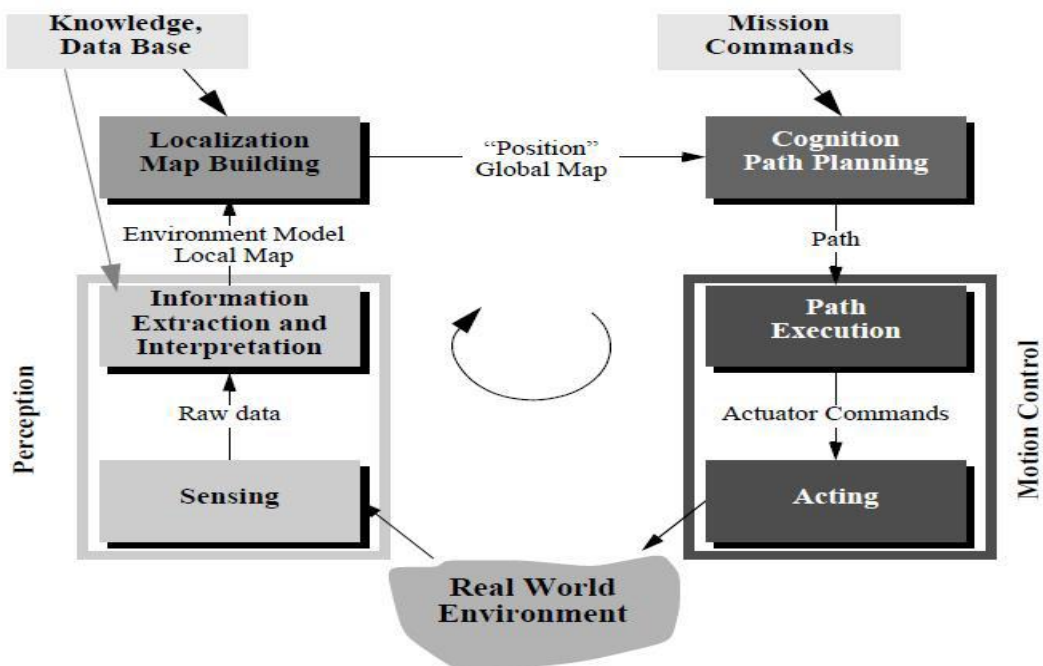
## MOBILE ROBOTS

A mobile robot is a machine controlled by software that use sensors and other technology to identify its surroundings and move around its environment. Mobile robots function using a combination of artificial intelligence (AI) and physical robotic elements, such as wheels, tracks and legs. Mobile robots are becoming increasingly popular across different business sectors. They are used to assist with work processes and even accomplish tasks that are impossible or dangerous for human workers.

Mobile robotics is the specific industry related to creating these locomotive robot systems. Humanoid robots, entertainment pets, drones, and underwater robots are some great examples of mobile robots. They can be distinguished from other robots because of their ability to move autonomously. These robots have enough intelligence to make the decision on the basis of algorithms where it can take input and learn from that and can match the predictive classifier and then give the expected output. They can make decisions on the basis of the perception they receive from the environment.

Mobile robots have a source of input data and they react by decode the input data to the outside world. In today's times, there are mobile robots that can walk, run, jump like a living component. And in the future due to these abilities, they can substitute humans in many fields.

### Control scheme for Mobile Robot Systems:



The figure explains how a robot works using a continuous sense–plan–act cycle. First, in the perception stage, the robot uses sensors to collect raw data from the real-world environment. This data is processed in the information extraction and interpretation step, where the robot understands the surroundings. Then, in localization and map building, it determines its position and creates a map using stored knowledge. This information is passed to the cognition stage, where the robot plans its path based on the given mission and the generated map. After planning, the motion control stage begins, where the path is executed and converted into commands for actuators. Finally, the robot acts by moving or performing tasks in the environment. This process keeps repeating in a loop, allowing the robot to continuously update its understanding and adjust its actions according to changes in the environment.

### **Uses and functions of mobile robots:**

The basic functions of a mobile robot include the ability to move and explore, transport payloads, or revenue producing cargo, and complete complex tasks using an onboard system, like robotic arms. While the industrial use of mobile robots is popular, especially in warehouses and distribution centers, its functions can also be applied to the medicine, surgery, personal assistance and security. Ocean and space exploration and navigation are also amongst the most common uses of mobile robots.

Mobile robots are being used to access areas, such as nuclear power plants, where factors, like high radiation, make the area too dangerous for humans to inspect and monitor themselves. However, current mobile robotics is not designing robots that can tolerate high radiation without their electronic circuitry being impacted. Attempts to invent mobile robots to deal specifically with these situations are currently being made. Other uses of mobile robots include:

- Shoreline exploration of mines
- Repairing ships
- A robotic pack dog or exoskeleton to carry heavy loads for military troopers
- Painting and stripping machines or other structures
- Robotic arms to assist doctors in surgery
- Manufacturing automated prosthetics that imitate the body's natural functions
- Patrolling and monitoring applications, such as surveilling thermal and other environmental conditions

### **Classification of Mobile Robots:**

Mobile robots can be classified in two ways as follows.

- Based on the environment in which they work.
- Based on the device they use to work.

### **Based on the Environment they work:**

Mobile Robots can be classified on the basis of the environment they work in as follows.

### **Aerial Robots –**

Aerial Robots are also known as Unmanned Aerial Vehicles (UAVs). These robots can fly through the air. eg-drones, helicopters, etc.

### **Land or Home Robots –**

Land Robots are also known as Unmanned Ground Vehicles (UGVs). These robots can navigate on dry land and within buildings of houses and offices. These are used to supply equipment .eg-dirt dog etc.

### **Underwater Robots –**

Underwater Robots are also known as Autonomous Underwater Vehicles (AUVs). These robots can direct themselves and travel through water in an efficient manner. eg-submarines etc.

### **Based on the device they use to work:**

Mobile Robots can be classified on the basis of devices they use to work as follows.

### **Wheeled Robots –**

Wheeled Robots are also known as Autonomous Intelligent Vehicles (AIVs). These robots are those robots that use wheels for their locomotion. There are different types of wheeled robots like one-wheeled robots, two-wheeled robots, etc.

### **Humanoid Robots –**

Humanoid robots are those robots that have their body shape, which resembles the human body. They work majorly on the basis of sensors .eg androids, etc.

### **Legged Robots –**

Legged robots are those robots that use articulated limbs like legs and follow a mechanism to provide locomotion .eg hexapod robot etc.

### **Features of Mobile Robots:**

- Mobile Robots provide wireless communication.
- They contain locomotion controlling softwares.
- They work majorly on predefined algorithms.
- They have hierarchical controlling structure.
- They are easy to operate and have more efficiency.
- Application fields of Mobile Robots:
- Education and Research

- Remote handling of explosive materials
- Military Mobile Robots
- Fire Fighting and Rescue
- Mining
- Construction
- Photography and Videography
- Planetary Exploration

**Advantages of mobile robots:**

- One major advantage of mobile robots is their computer vision capabilities. The complex array of sensors used by mobile robots to detect their surroundings allows them to accurately observe their environment in Real Time. This is valuable especially in industrial settings that are constantly changing and shifting.
- The onboard intelligence system and AI used by AMRs creates another advantage. The autonomy provided by the mobile robots' ability to learn their surroundings through either an uploaded blueprint or by driving around and developing a map, enables the quick adaption to new environments and assists in the continued pursuit of industrial productivity.
- Furthermore, mobile robots are flexible and quick to implement -- since they can create their own pathways and easily adapt -- possible to break up the implementation into different installations with a modular Deployment system and capable of removing the potential for human error by performing easily repeatable tasks, thus improving the safety of a facility or area.

**Disadvantages of mobile robots include:**

- Limitations on the size of the load that can be carried;
- Requiring large amounts of skus to operate at the highest level and
- Continued challenges with wireless connections between the robot and information endpoint