BRAC UNIVERSITY
Inspiring Excellence

Course Name : Introduction to Robotics
Course : CSE461
Chapter 1 (Introduction to robotics basics)
Class Note [Chapter 1 Part 1]

What is a robot?

An embodied agent that can be programmed to perform physical tasks. An embodied agent is an AI system that has a physical presence and can be programmed to perform physical tasks in the environment it is situated in.

Robotics:

Robotics is a branch of engineering and computer science that deals with the design, construction, operation, and use of robots.

Family Robots:

Aibo:

1. can recognize faces and voices
2. interact with its environment in a natural and intuitive way
3. navigate around obstacles, avoid falls, and recognize and respond to human voices and commands.
4. rolling over and shaking hands, and has a range of moods and personalities that can be customized using an accompanying mobile app

Kirobo Mini:

The robot's design is based on a character from the Japanese anime series "Astro Boy", and it has a cute and expressive appearance. Kirobo Mini can move its arms and head, and it has a number of pre-programmed movements and expressions.

KUBO:

The KUBO robot is a small, cube-shaped device that can be programmed using physical coding blocks. The coding blocks are color-coded, and children can easily snap them together to create programs that control the robot's movement and behavior. The robot also has a range of sensors that allow it to interact with its environment and perform a range of tasks.

NAO:

NAO is designed to be a versatile platform for research and education, and is used in a wide range of settings, including universities, research labs, and schools. Its capabilities include recognizing faces and voices, moving autonomously, playing games, and performing a range of tasks such as dancing, singing, and storytelling.

What are the laws of robotics:

The laws of robotics were first introduced by science fiction writer Isaac Asimov in his 1942 short story "Runaround" and later expanded upon in his "Robot" series of novels. They are a set of three (or sometimes four) ethical guidelines intended to govern the behavior of intelligent robots:

1. **A robot may not injure a human being, or through inaction, allow a human being to come to harm** : This law requires that robots prioritize the safety and well-being of humans above all else. It means that a robot should not intentionally harm a human, and it should take action to prevent harm from coming to a human if it is within the robot's power to do so.
2. **A robot must obey orders given to it by human beings, except where such orders would conflict with the first law :** This law establishes that robots must obey human instructions as long as those instructions do not conflict with the first law. It means that a robot cannot be programmed or instructed to harm humans.
3. **A robot must protect its own existence as long as such protection does not conflict with the first or second law:** This law allows robots to take action to preserve their own existence, but only if doing so does not conflict with the first two laws. Essentially, it means that a robot should not sacrifice its own safety or well-being in order to protect humans or follow human orders.
4. **A robot should always have a kill switch:** This "law" is not an official part of Asimov's original Three Laws, but it is sometimes added as an additional guideline for robot safety. A kill switch is a mechanism that allows a human operator to shut down a robot in case of an emergency or malfunction. The idea is that the robot should always be under human control and should never be allowed to cause harm without a way to shut it down quickly.

What is 4D in robotics and how can robotics be useful in handling this term?

The 4D (Dull, Dirty, Difficult, and Dangerous) concept refers to tasks that are tedious, hazardous, or physically demanding, making them unsuitable or even impossible for humans to perform. Robotics technology is ideally suited for performing such tasks, as it allows for automation and remote control of equipment, thus reducing the risk to human operators.

Here's how each of the 4D categories can be applied to robotics:

Dull: Tasks that are repetitive and monotonous, such as assembly line work, can be automated using robots. This reduces the risk of errors and allows humans to focus on more creative and strategic tasks.

Dirty: Tasks that involve exposure to hazardous materials, such as cleaning up radioactive waste or handling toxic chemicals, can be performed by robots. This protects human workers from exposure to dangerous substances and reduces the risk of contamination.

Difficult: Tasks that require physical strength or agility, such as lifting heavy objects or working in tight spaces, can be performed by robots. This reduces the risk of injury to human workers and increases efficiency by allowing robots to perform tasks that would be difficult or impossible for humans.

Dangerous: Tasks that are hazardous to human life, such as working in mines, handling explosives, or conducting search and rescue operations in disaster zones, can be performed by robots. This reduces the risk of injury or death to human workers and allows robots to perform tasks that would be too dangerous for humans to attempt.

Overall, the 4D concept highlights the value of robotics in automating tasks that are dull, dirty, difficult, or dangerous, thus improving safety, efficiency, and productivity in various industries.

Thumb Rules on the decision of a Robot Uses:

1. The first rule to consider, what is known as the Four D of Robotics, i.e. is the task dirty, dull, dangerous, or difficult? If so, a human will probably not be able to do the job efficiently. Therefore, the job is appropriate for automation or for robotic labor.
2. The second rule is that a robot may not leave a human jobless. Robotics and automation must serve to make our lives more enjoyable, not miserable.
3. A third rule involves asking whether you can find people who are willing to do the job. If not, the job is a candidate for automation and Robotics.
4. A four rule of thumb is that the use of robots or automation must make short-term and long-term economic sense.