Robots and Robotics

What is your image of a robot?

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Perhaps something based on the Tin Man in The Wizard of Oz?

Then perhaps you are thinking of Elektro – and his dog





Elektro appeared at The 1939 World's Fair in New York. He was accompanied a year later by his dog Sparko

Elektro was the first robot capable of walking, but only just, because he could only bend his left leg!

Things have moved on a little since 1939

But we need to look at some history and a few definitions before going any further

Origin of the word Robot

Robot

The term was coined in K. Čapek's play R.U.R "Rossum's Universal Robots'" (1920)

The word "Robot" is derived from the Czech word for work - Robota. Also similar in Russian, as Robata - or in Cyrillic as Работа



What are the actual characteristics of a robot?

Some definitions -I

A robot is a machine resembling a human being and able to replicate certain human movements and functions automatically.

A robot is a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer

A robot is a reprogrammable multifunctional automatic industrial machine designed to replace humans in e.g. repetitive, or high accuracy, or hazardous work environments

Some definitions -II

Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of *robots*

The word was coined by Isaac Asimov in 1941

The Three Laws of Robotics

Law One: A robot may not injure a human (or humanity), or, through inaction, allow a human (or humanity) to come to harm.

Law Two: A robot must obey orders given it by human beings, except where such orders would conflict with a higher order law.

Law Three: A robot must protect its own existence as long as such protection does not conflict with a higher order law

Law Zero (added later!): A robot may not injure a human being, or, through inaction, allow a human being to come to harm, unless this would violate a higher order law

Foundation of robotics

The first digital programmable robot was Unimate. Concept created in 1954. Sold to General Motors in 1960

Unimate - the first digital programmable robot

The First Robot "UNIMATE" Unimate was the first industrial robot



It was created by George Devol in the 1950s using his original patent filed in 1954 and

The machine undertook the job of transporting die castings from an assembly line and welding these parts on auto bodies, a dangerous task for workers, who might be poisoned by toxic fumes or lose a limb if they were not careful.

The original Unimate consisted of a large computer-like box, joined to another box and was connected to an arm, with systematic tasks stored in a drum memory. In 2003 the Unimate was inducted into the Robot Hall of Fame

Six degrees of freedom

Translation: The first three degrees of freedom comprise the ability to move along all three axes independently



Six degrees of freedom

Rotation: The second three degrees of freedom comprise the ability to rotate around all three axes independently



Industrial robots - Unimate and it's successors have six degrees of freedom



Unimate and other industrial robots at work - Kia Sportage production line



Industrial robots - working together



Industrial robots - precision working



Industrial robots - density by country in 2016 - I

IFR



Industrial robots - density by country in 2016 - II



Industrial robots - growth to 2016 and forecast



Industrial robots - implications for employment

- Reduction in number of low-level manual jobs is inevitable
- Need to retrain employees made redundant
- Social cost implications if redundant operatives cannot be easily redeployed
- Need to refocus education to cope with massively increasing displacement of manual jobs

There are many classes of robots

- Industrial robots where it all began
- Electronic assembly
- Service robots
- Driverless cars
- Autonomous planes and submersibles
- Military robots
- Bomb disposal robots

- Search and rescue robots
- Healthcare and assistance robots
- Mining robots
- Medical robots
- Nanobots
- Cobots

Medical robots can be subdivided

Surgical robots

These robots either allow surgical operations to be carried out with greater precision than an unaided human surgeon, or allow remote surgery where a human surgeon is not physically present with the patient.

Rehabilitation robots

This group facilitates and supports the lives of infirm, elderly people, or those with dysfunction of body parts effecting movement. These robots are also used for rehabilitation and related procedures, such as training and therapy.

Bio robots

A group of robots designed to imitate the cognition of humans and animals.

Telepresence robots

Allow off-site medical professionals to move, look around, communicate, and participate from remote locations

Pharmacy automation

Robotic systems to dispense oral solids in a retail pharmacy setting or preparing sterile IV admixtures in a hospital pharmacy setting.

Disinfection robot has the capability to disinfect a whole room in mere minutes, generally using ultraviolet light technology. They were used to fight Ebola virus disease.

Surgical robots



The Da Vinci robot.

Note that this appears to be a training session. The patient is a dummy and the surgeon at his/her console is surrounded by smiling technicians – no mask; no gown, and no gloves!

Robotic bomb disposal



Bomb disposal robots have become very sophisticated in the last 45 years!

First developed in 1972 and hastily improvised on a motorised wheelbarrow chassis – and remote controlled by ropes



Service robots

Service robots assist human beings, typically by performing a job that is dirty, dull, distant, dangerous or repetitive, including household chores. They typically are autonomous and/or operated by a built-in control system, with manual override options







Drones





first day with my drone....



COBOTS - collaborative robots



Military robots

The US Defense Advanced Research Projects Agency (DARPA) has sponsored significant work on autonomous robots with a view to using them in the field. Sit back and watch a few amazing videos from Boston Dynamics, and MIT

Boston Dynamics

Big Dog



Boston Dynamics





Boston Dynamics





Massachusetts Institute of Technology

Cheetah



Honda has worked on autonomous humanoid robots for nearly three decades

Introducing ASIMO

Honda



