University of Reading

Begin robotics: Glossary of terms

This glossary explains some of the words and phrases that we use in the course. It's a work in progress, so if there's anything you think is missing, let us know in the comments and we'll add them to the document.

Name	Description
Acceleration	A change in velocity (that is changing speed and/or direction of travel).
Accelerometer	A device for measuring acceleration or force (these are related by Newton's second law: force = mass * acceleration
Accuracy	How close a measured value is to the actual value (see **precision** also).
Active sensor	A sensor which instigates an action and then waits for a response – such as transmitting a signal and measuring the response when it comes back – constant Passive sensor.
Actuator	A device which makes something happen – such as a motor for movement, an emitter (of say light or ultrasound).
Aggressive Light phobe	A form of Braitenberg vehicle which accelerates away from lights.
Aggressive Light seeker	A form of Braitenberg vehicle which accelerates towards lights.

Algorithm	A set of actions which, if followed, achieve a particular task. These are typically expressed in a language a human can 'understand' and may be converted into specific commands that a machine such as a computer can obey.
Android	A robot which looks (to an extent) like a human.
Artificial Intelligence	Intelligence associated with a machine.
Artificial Life	The simulation of the behaviour and other characteristics of life typically by computers, robots or biochemical processes – named by Chris Langton.
Assembly robot	A robot used typically in a production line manufacturing (e.g. cars).
Autonomous robot	A robot which works on its own, as opposed to being controlled by a human.
Baxter robot	A modern industrial robot designed specifically to interact safely with humans.
Boids	Examples of artificial life, first produced by Craig Reynolds which appear to flock.
Brain-computer interface	A direct connection between a brain and a computer, allowing the brain to command the computer or the computer to monitor the brain.
Braitenberg vehicles	A form of robot, proposed by the Italian-Austrian cyberneticist Valentino Braitenberg whose actions are determined by its light sensors and neurons.
Capacitor	An electronic component used to store energy electrostatically – as current flows into a capacitor, it charges up, so the voltage across it increases.
Closed Loop control	A feedback loop used to control a device.
Control Engineering	A study of how to achieve control.

Controller	A device which forms part of a control system – often taking the error between the desired state and the actual state and generating data used to affect an actuator.
Coordinates	A set of numbers used to represent a position –often there are two or three dimensional positions.
Cybernetics	The science of control and communication (in the animal and the machine) – the science of feedback systems – incorporating control, learning and interaction.
Cyborg	A cybernetic organism comprising a mixture of organic and mechanical electronic components.
Daisyworld	An imaginary planet, populated with artificial life, created by James Lovelock and Andrew Watson to demonstrate aspects of Gaia Theory.
Degrees	A measurement of an angle. A complete rotation is 360 degrees: a right angle is 90 degrees.
Degrees of freedom	In robotics, the number of independent modes in which a robot can operate.
Differentiation	Mathematically the process of finding the derivative or rate of change of a function – an aspect of calculus – and the inverse of integration.
Echo location	A process where the position of an object is determined by emitting a signal and seeing how long before that signal returns.
Electronics	The science of the flow and control of electrons from devices such as batteries through electric components such as resistors and motors.
Encoder	In robotics this is a device used to generate pulses as a wheel turns, which can be used to measure velocity.
End effector	A device or tool at the end of a robot hand.
Error	In a control system, the difference between the desired state and the actual state.

Excitatory	A connection between neurons which enhances action (as used in Neural Networks and Braitenberg vehicles).
Feedback	The process of returning information about the output of a system.
Feedback Loop	A circular path along which information is passed.
Firmware	A type of software which provides direct access to the device's hardware.
Flocking behaviour	The coordinated movement of a number of real or simulated animals e.g. birds flying, sheep moving together, schools of fish, or boids.
Force	The strength associated with action or movement.
Force Feedback	A method whereby a sensor conveys to the user the force felt when touching an object.
Fuzzy Logic	A form of logic which deals with approximate values, as opposed to logic signals which are true or false only.
Gaia Theory	As proposed by James Lovelock: Earth and the Life on it act together to influence the environment – such as its temperature.
Gain	The size of the output of an element divided by its input – in a Proportional Controller, its output is the error * the gain.
Game of Life	A cellular automaton where a computer organism evolves over time, where its current state is determined by its previous state. It was devised by John Conway in 1970.
Grimblebot	A self-balancing robot designed at the University of Reading.
Gripper	An end effector used for sizing or holding something (a simple hand).

Haptics	Interaction involving the sense of touch.
Hardware	The physical components of a computer.
Human Computer Interaction (HCI)	The design and use of computer technology which allows humans to interface with computers.
Hydraulics	The science covering the laws governing the motion and application of liquids.
Industrial robot	A multi-functional manipulator which can be programmed to do various tasks.
Infrared sensor	An electronic sensor (often passive) that measures infrared light radiating from objects in its view. Infrared signals have wavelengths longer than those of visible light.
Inhibitory	A connection between neurons which inhibits action (as used in Neural Networks and Braitenberg vehicles).
Input device	One of many different devices which allow a human to interact with a machine like a computer or robot – including keyboard, mouse, touchpad.
Insect robot	A small mobile robot.
Instruction	A piece of a program commanding the computer to do something.
Integral control	A method used in Feedback Control where the output of the controller depends on its input (typically the error) and previous values of its output.
Integrated development environment (IDE)	A computer program which provides the facilities to allow a programmer to develop other programs.
Integration	Mathematically the process of finding the integral of a function – an aspect of calculus – and the inverse of differentiation. An integral can be considered the area under a function.

Intelligence	The ability to acquire and apply skills and knowledge.
Intelligent robot	A robot whose actions are at least in part determined by the robot.
Joint	A part of a robot manipulator which allows some form of rotation (humans also have joints at our wrist, elbow, shoulder, for instance).
Laser	Stands for Light amplification by Stimulated Emission of Radiation. A device which emits a beam of light – can be used in sensing.
Law of Robotics	The laws defined by Isaac Asimov in his stories of robots – to define their behaviour.
Light Dependent Resistor (LDR)	See **Phototransistor**.
Light phobe	A form of Braitenberg vehicle which steers away from lights.
Light seeker	A form of Braitenberg vehicle which steers towards lights.
Linear motion	Movement in a straight line, as opposed to rotating.
Link	A rigid part of a manipulator.
Localization	In robotics it is about determining where a robot is.
Logic	A branch of mathematics concerned with signals that can be only true or false, and which form the basis of modern computers.
Machina Speculatrix	A robot developed by W. Grey Walter in the 1940s which seeks light.

Machine learning	The construction and study of algorithms that can learn from data and make predictions using data.
Magnetometer	A device for detecting magnetic fields.
Manipulator	A robotic mechanism typically comprising a series of fixed elements joined together at joints.
Mechatronics	In engineering a combination of mechanical, electrical, control, computer and communication engineering.
Microcontroller	A small computer system, typically on a single integrated circuit, comprising the microprocessor, memory and peripherals.
Motor	A power mechanism used to produce motion – either in a straight line or by rotating.
Neural Network	A set of neurons connected together.
Neuron	A simple processing element in a brain – the human has billions of them.
Optical Encoder	A device for measuring linear or rotary motion by detecting beams of light as the encoder passes by a light.
Passive sensor	A sensor which just 'listens' for information (in contrast with an active sensor).
Pheromone	A chemical signal emitted by a body which triggers response in others.
Photoelectric sensor	A sensor which uses light (often infrared) to detect the presence of an object or the distance to it.
Phototransistor	Also called Light Dependent Resistor (LDR) – a resistor whose resistance decreases with increasing incident light.

Pitch	The steepness of a slope/ for a flying object it is its rotation around the 'side-to-side' axis (see **Roll** and **Yaw** also).
Pneumatics	The science covering the laws governing the motion and application of gases.
Position	Where something is.
Precision	How close measured values are to each other.
Program	A series of instructions which can be obeyed (by a computer or a robot) to achieve a task.
Proportional Control	A strategy where the controller outputs a value which is the error multiplied by a constant (is proportional to the error).
Proportional plus Derivative Control	A strategy where the controller output is an amount proportional to the error plus an amount due to the differential of the error. Also known as P+D control.
Proportional plus Integral Control	A strategy where the controller output is an amount proportional to the error plus an amount due to the integral of the error. Also known as P+I control.
Proportional plus Integral plus Derivative Control	A strategy where the controller output is an amount proportional to the error plus an amount due to the integral of the error plus an amount due to the differential of the error. Also known as PID or Three Term Control.
Pulse Width Modulation (PWM)	A technique for generating an analog value using a digital signal: the signal is repeatedly switched between two values but the time in each state varies – and that is the analog value generated.
R2-D2	A robot in the Star Wars films and books.
Radians	A measurement of an angle. A complete rotation is 2π radians (a circle radius r has circumference $2\pi r$): a right angle is $\pi/2$ radians.
Resistor	An electronic component with a property of resistance: the voltage across a resistor equals the current flowing through it multiplied by the resistance.

Robot	That is what the course is about!
Roll	Rotation of an airplane around the 'front-to-back' axis (see **Pitch** and **Yaw** also).
Rotary motion	Movement where something turns on the spot, or around a joint.
Quadrature	In electronics the relationship between two signals 90^{O} out of phase.
Quadrature encoder	An encoder which generates two signals out of phase – the frequency at which they change indicates speed, which comes first indicates the direction.
Sensor	A device which is used to measure a quantity – such as the distance to an object or the speed of a robot.
Servo/ Servomechanism	An automatic device which uses feedback control to determine its output: it comprises the device under control, appropriate sensors and the control mechanism.
Servomotor	A servomechanism which includes a motor and associated sensors to enable its position or velocity to be controlled.
Shy Light seeker	A form of Braitenberg vehicle which seeks lights but slows when it approaches them.
Signal	In Electronics it is a current/voltage/electromagnetic field used to convey information.
Simulation	A computer program which tries to emulate the behaviour of something – in this course we use simulations of robots moving around an arena.
Software	A set of instructions which direct how a computer performs specific tasks.
Subsumption architecture	A method proposed by Rodney Brooks to determine which course of action is more important for a robot than others.

System	A set of 'things' which work together.
Touch sensor	A sensor which measures some aspect of the physical contact with an object.
Transducer	A device which converts energy from one form to another – e.g. motor speed to an electrical signal.
Ultrasound	Sound that is at a frequency higher than humans can hear.
Ultrasonic sensor	A sensor which emits ultrasound and then detects any ultrasound that returns.
Velocity	The speed at which an object is travelling and the direction in which it is travelling.
Velocity feedback	Where the signal feedback is the change in (or differential) of a signal.
Vision Sensor	A device which gives a visual representation of something – typically from a camera.
Yaw	The rotation of a flying object about its vertical axis (see **Roll** and **Pitch** also).