
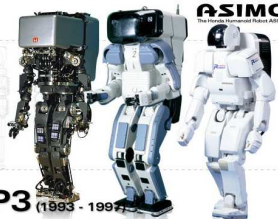


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Histórico - 1996: Honda P2

Honda's first public showing of a Biped Robot after a 10 year development program

P2	
Prototype Model 2 1993-1997	
First humanoid stunned the public with realistic movement.	
The world's first self-regulating, two-legged humanoid walking robot debuted in December, 1996. Height: 1,820mm, Weight: 210kg. Using wireless techniques, the torso contained a computer, motor drives, battery, wireless radio and other necessary devices, all of which were built in. Independent walking, walking up and down stairs, cart pushing and other operations were achieved without wires, allowing independent operation.	
	
	P1-P2-P3 (1993 - 1997) History of Humanoids

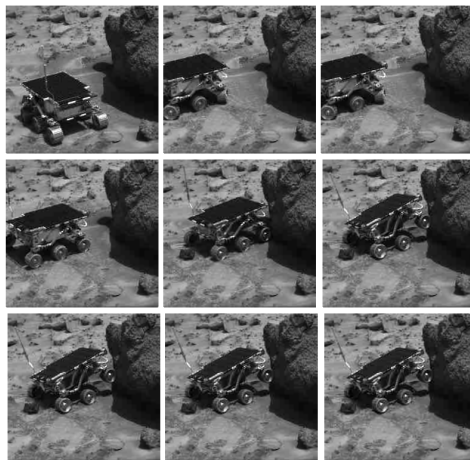
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Home > History > History of Humanoids > P1 - P2 - P3

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1997 Mars Rover: Sojourner / PathFinder



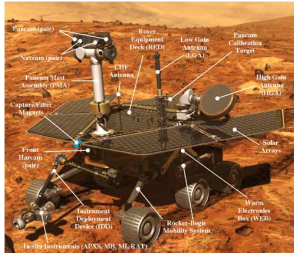
The rover goes a little too far and begins to climb Yogi (NASA)



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2004: Spirit and Opportunity



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Histórico:

ActivRobots / MobileRobots 1995 - Pioneer

iRobot 2002 - Roomba

The Roomba is a robotic vacuum cleaner made and sold by iRobot.

The Roomba was introduced in 2002; several updates and new models have since been released. As of January 2008, over 2.5 million units have been sold.

Boston Dynamics 2005 - BigDog

Sony 1999-2006 - Aibo



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Mobile Robots – Wikipedia : http://en.wikipedia.org/wiki/Mobile_robots

- 1995 The Pioneer programmable mobile robot becomes commercially available at an affordable price, enabling a widespread increase in robotics research and university study over the next decade as mobile robotics becomes a standard part of the university curriculum.
- 1996-1997 NASA sends the Mars Pathfinder with its rover Sojourner to Mars. The rover explores the surface, commanded from earth. Sojourner was equipped with a hazard avoidance system. This enabled Sojourner to autonomously find its way through unknown martian terrain.
- 1999 Sony introduces Aibo, a robotic dog capable of seeing, walking and interacting with its environment. The PackBot remote-controlled military mobile robot is introduced.
- 2001 Start of the Swarm-bots project. Swarm bots resemble insect colonies. Typically they consist of a large number of individual simple robots, that can interact with each other and together perform complex tasks.
- 2002 Appears Roomba, a domestic autonomous mobile robot that cleans the floor.
- 2004 Robosapien, a biomorphic toy robot designed by Mark Tilden is commercially available. In 'The Centibots Project' 100 autonomous robots work together to make a map of an unknown environment and search for objects within the environment.
- 2004 In the first DARPA Grand Challenge competition, fully autonomous vehicles compete against each other on a desert course.
- 2005 Boston Dynamics creates a quadruped robot intended to carry heavy loads across terrain too rough for vehicles.
- 2006 Sony stops making Aibo and HelpMate halts production, but a lower-cost PatrolBot customizable autonomous service robot system becomes available as mobile robots continue the struggle to become commercially viable. The US Department of Defense drops the MDARS-I project, but funds MDARS-E, an autonomous field robot. TALON-Sword, the first commercially available robot with grenade launcher and other integrated weapons options, is released. Honda's Asimo learns to run and climb stairs.
- 2007 History is made with the DARPA Urban Grand Challenge, with six vehicles autonomously completing a complex course involving manned vehicles and obstacles. Seekur, the first widely available, non-military outdoor service robot, pulls a 3-ton vehicle across a parking lot , drives autonomously indoors and begins learning how to navigate itself outside. Meanwhile, PatrolBot learns to follow.

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DARPA Challenge

2004 - Darpa Grand Challenge – Prêmio: US\$ 1 Milhão - Sem Vencedores

First Grand Challenge, held on March 13, 2004, when only 13 teams were able to field machines for the **142-mile course and none cleared the first mountain crossing** (see "A New Race of Robots," by W. Wayt Gibbs; SCIENTIFIC AMERICAN, March 2004).

2005 - Darpa Grand Challenge – Prêmio: US\$ 2 Milhões - Vencedor: Stanley / Stanford

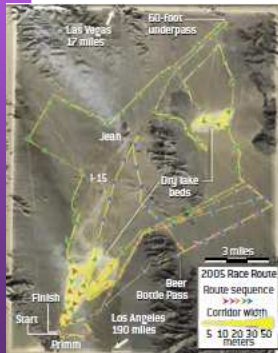
Five out of 23 competing robots successfully navigated a 132-mile course through the Mojave Desert in October 2005 as part of the DARPA Grand Challenge race. **To qualify** for the \$2-million prize, the driverless vehicles had to finish **in less than 10 hours**. **Four turned in elapsed times under 7.5 hours**.

2007 – Darpa Urban Challenge – Prêmio: US\$ 2 milhões – Vencedor: Boss / CMU

The Urban Challenge, announced in April 2006, called for autonomous vehicles to drive 97 km through an urban environment, interacting with other moving vehicles and obeying the California Driver Handbook. Interest in the event was immense, with 89 teams from around the world registering interest in competing. Competition took place on November 3, 2007.

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DARPA
 Grand Challenge



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MACHINE ON A MISSION. Soudstorm swerves its laser-aiming "eye" (middle silver dome) to peer around a tight turn as it negotiates Beer Burde Pass in the 2005 Grand Challenge race, followed by a 2005 Humvee. The autonomous Humvee drove the 132-mile course at an average speed of 18.6 miles an hour but was bested by a slightly faster robot.

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DARPA Grand Challenge



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A MOTORCYCLE THAT STEERS ITSELF

- When not in motion, the motorbike rests on retractable landing gear (a).
- Guided by microelectromechanical sensors that measure the bike's orientation, onboard computers steer the front wheel gently left or right to keep the vehicle upright and driving straight (b).
- To make a right turn, the robot first jerks its front wheel briefly to the left (c), which causes the body to lean over to the right.
- ... then straightens its wheel as the chassis continues to tip right (d), and finally steers right (e) to halt its fall. The vehicle holds this pose, in which the push of centrifugal force balances the pull of gravity, for the duration of the turn.
- To exit the turn, the robot kicks the front wheel even farther to the right (f), which increases the centrifugal force and rights the motorbike.
- A quick flick of the wheel to the left (g) halts the rotation of the chassis and puts the vehicle back on a straight heading (h).

GHOS RIDER ran unassisted for 20 miles at a time in desert testing.



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DARPA
 Grand
 Challenge

ROBOTS THAT SEE AROUND CORNERS

Obstacle (utility tower)

Spinning 64-laser scanner

3-D point cloud

Cost map

Utility tower

Most laser scanners pan a single infrared beam over a region, then translate the reflections into a 3-D model called a point cloud. Team DAD's novel scanner spins 64 fixed lasers at about 600 rpm, tracing out a highly detailed model. From this model, obstacle-detection software creates a 2-D "cost map" in which smooth, level ground has a low cost (green) and anything that slopes or rises above the ground carries a higher cost (red). The optimal path presents the lowest cost and permits the highest speed.

Pitch axis

Roll axis

Antireflective glass windshield

Long-range laser scanner

Three-axis gimbal on the Red Team's Highlander and Sandstorm robots is able to pitch, roll and yaw to point the laser scanner in any forward direction.

Highlander

Gimbal

Unreliable scan

DAD

Highlander

Gimbal

Reliable scan

Hairpin turns are typically blind turns for robots. But DAD, Highlander and Sandstorm can often see the other side of a tight curve before they get there. DAD has a full 180-degree field of view; the Red Team robots swivel their gimbals.

Rough roads jostle fixed lasers, creating gaps in the 3-D model. The Red Team gimbal senses such jolts with fiber-optic gyroscopes, then uses its actuators to cancel out the motion. The result is more reliable perception, especially when looking far ahead.

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DARPA Grand Challenge

VISION LINKED TO SPEED

Smart speed switch, which helped Stanley win the 2005 Grand Challenge, combines laser and video sensors in a four-step process. First, the robot filters its laser data to identify a section of terrain ahead that is smooth and relatively flat (green). Second, a program finds the corresponding patch of road in the video frame sent by the onboard camera (blue outlines). Next, the system highlights all other areas in the same video frame that match that pattern, which it equates with good, drivable road (pink areas). Finally, the software checks whether the matching area completely fills the robot's intended path for the next 130 feet (orange). If it does, then the system concludes that a long stretch of open road lies ahead, and it informs the onboard planning computer that it is safe to step on the gas.

Trinocular Terramax (right) can build a 3-D stereo view of the world from any of three pairs (arrows) of color video cameras. The closest cameras (purple), used at slow speeds, can detect obstacles up to 50 feet away. At fast speeds the robot selects its widest pair (orange), which can pick up objects 65 to 165 feet ahead. The third pair (pink) offers a happy medium.

Video from onboard camera

Laser scan lines

Camera and five laser scanners

Ranges for three camera pairs

Video from onboard camera

Terramax might first detect the pillars of an underpass with its long-range stereo cameras (orange zone above). As the vehicle slows, it will switch to medium- and then short-range camera pairs to make certain it notices all the obstacles in its video scene (inset).

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DARPA Grand Challenge

Ganhadores – Stanley / Stanford University

Sebastian Thrun, Mike Montemero, Hendrik Dahkamp, David Stavens, Andrei Aron, James Diebel, Philip Fong, John Gale, Morgan Halpenny, Gabriel Hoffmann, Kenny Lau, Celia Oakley, Mark Palatucci, Vaughan Pratt, and Pascal Stang
Stanford Artificial Intelligence Laboratory- Stanford University - Stanford, California 94305
Sven Strohband, Cedric Dupont, Lars-Erik Jendrosseck, Christian Koelen, Charles Markey, Carlo Rummel, Joe van Niekark, Eric Jensen, and Philippe Alessandrini
Volkswagen of America, Inc. - Electronics Research Laboratory - Palo Alto, California
Gary Brasiski, Bob Davies, Scott Ettinger, Adrian Kaehler, and Ara Nefian
Intel Research - 2200 Mission College Boulevard
Santa Clara, California 95052
Pamela Mahoney
Mohr Davidow Ventures
Menlo Park, California 94025



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DARPA Urban Challenge

Boss, the autonomous Chevy Tahoe that won the 2007 DARPA Urban Challenge

Tartan Racing – CMU Carnegie Mellon University

Pittsburgh, Pennsylvania

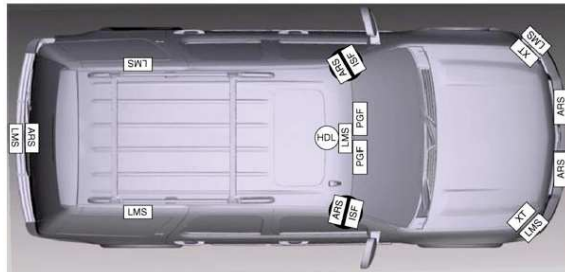


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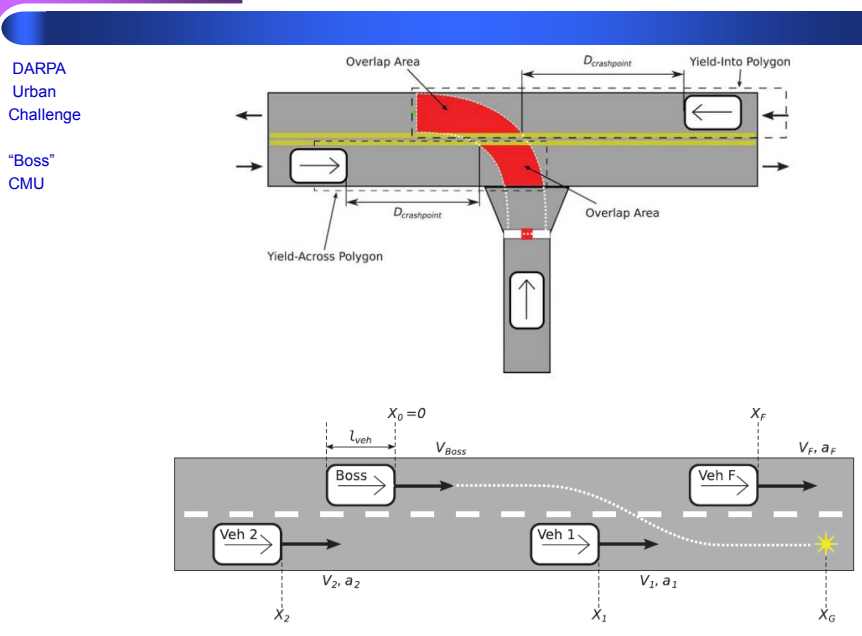
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Sensor	Characteristics
Applanix POS-LV 220/420 GPS/IMU (APLX)	<ul style="list-style-type: none"> • Submeter accuracy with Omnistar VBS corrections • Tightly coupled inertial/GPS bridges GPS outages
SICK LMS 291-S05/S14 LIDAR (LMS)	<ul style="list-style-type: none"> • 180/90 deg × 0.9 deg FOV with 1/0.5-deg angular resolution • 80-m maximum range
Velodyne HDL-64 LIDAR (HDL)	<ul style="list-style-type: none"> • 360 × 26-deg FOV with 0.1-deg angular resolution • 70-m maximum range
Continental ISF 172 LIDAR (ISF)	<ul style="list-style-type: none"> • 12 × 3.2 deg FOV • 150-m maximum range
IBEO Alasca XT LIDAR (XT)	<ul style="list-style-type: none"> • 240 × 3.2 deg FOV • 300-m maximum range
Continental ARS 300 Radar (ARS)	<ul style="list-style-type: none"> • 60/17 deg × 3.2 deg FOV • 60-m/200-m maximum range
Point Grey Firefly (PGF)	<ul style="list-style-type: none"> • High-dynamic-range camera • 45-deg FOV



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Tipos de Robôs

Tipos de Robôs

Tipo de Mobilidade

- Base Fixa (manipuladores, braço robótico)
- Base Móvel: Com Restrição (grua) / Sem Restrição (veículo)

Tipo de Mecanismo de Locomoção

- Pernas, Rodas, Esteiras, Propulsão

Tipo de Local de Atuação

- Indoor (locais fechados, internos)
- Outdoor: Estruturados (estradas), Não Estruturados (off-road)

Tipo de Autonomia

- Controle e Ações Pré-Definidas
- Tele-Operados (tele-comandado)
- Semi-Autônomo (tele-operado + ações independentes)
- Autônomo : sem intervenção humana durante a operação

Percepção
Decisão
Ação

