

into reality

ASIMO has two arms and two hands – to perform tasks such as reaching for and grasping objects, switching lights on and off, carrying or moving things, or opening and closing doors.

One day, ASIMO will be truly useful in helping people with important tasks, like assisting an elderly person, or getting medicine for someone confined to a bed or a wheelchair.

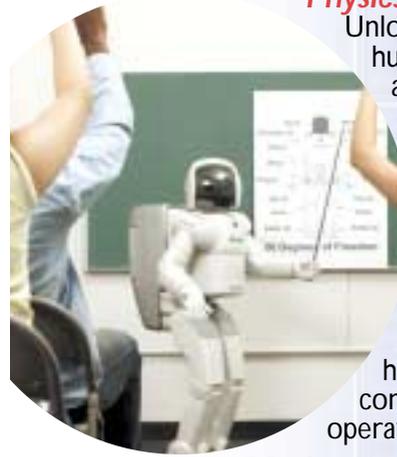
ASIMO may also someday be helpful in dangerous work environments such as moving harmful chemicals or fighting fires.

In all, ASIMO will someday serve as another set of eyes, ears, hands and legs for all kinds of people in need.



Powering the DREAM

ASIMO's design, development, and construction are the result of contributions from experts in many fields of academic study –



Physics...

Unlocking the physics behind human walking was the first and most important step in understanding how to create a bipedal robot.

Anatomy...

Studying the structure of the human body and how different parts are related and work together provided a blueprint for how a walking robot must be constructed to move and operate like humans.

Mathematics...

Experts in mathematics disciplines helped create the algorithms that allow ASIMO to walk and maintain balance as humans do.

Computer Sciences...

Experts in computer hardware and software development translated the research of physicists and mathematicians into information that ASIMO can understand.

Chemistry...

A clear understanding of material compositions resulted in a lightweight, super-strong structure and powerful, efficient batteries to power ASIMO.

Mechanical and electrical engineering...

Combining all the research and knowledge of other scientific disciplines studying ASIMO, mechanical and electrical engineers worked together to make ASIMO a physical reality.

To learn more about career opportunities at Honda, please visit the sites below:

www.honda.com
www.hondaresearch.com

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ASIMO

TECHNOLOGY CIRCUIT



Turning a dream

Walking is the most basic form of mobility for people. That's why Honda, a company committed to expanding and enhancing human mobility, has taken an amazing step forward in creating 'ASIMO,' the world's most advanced humanoid robot that is able to walk and move like a human.

ASIMO stands for 'Advanced Step in Innovative Mobility.' ASIMO can walk forward and backward, turn corners, walk up and down stairs, and even kick a soccer ball – all with a remarkable sense of balance and agility.



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why create a humanoid robot?

The dream sounds simple. Design a robot that can duplicate the complexities of human motion and genuinely help people.

An easy task? Not quite. ASIMO took more than 15 years of persistent study, research, trial and error before Honda engineers achieved their dream of creating the world's most advanced humanoid robot.



timeline

1986

Understanding how to walk on two legs

Honda's first two-legged experimental robot, named EO, was capable only of 'static walking,' meaning it could only walk in a straight line and on a flat surface. Each step forward took between five to twenty seconds for EO to complete.

Is walking really that difficult? Yes. Walking involves hundreds of specific motions. Each step people take not only requires their feet to propel them forward, but their hips, spine, arms, shoulders and head must move together in sync, in order to maintain balance.

1987-1993

Success in walking on two legs

When people take a step forward, they get just off-balance, as if they're about to fall forward. Right before losing balance, people throw one foot ahead for support. This series of movements, when repeated, is called 'dynamic walking.'

In the next series of experimental robots, Honda engineers achieved a complex dynamic walk, similar to how people actually walk.

With the basic principles of walking firmly established, engineers next learned how to make the robot walk on an incline and climb stairs.

did you know?

- ▶ Carnegie Mellon University established a Robot Hall of Fame in 2003 to honor landmark achievements in robotics technology and to recognize the increasing contributions of robots to society. ASIMO entered the Robot Hall of Fame in 2004 as the first real world humanoid robot to be inducted.
- ▶ Many technology analysts predict that by 2040, most households will own a personal robot, or at least be considering one.
- ▶ The Robotics Industry is currently an \$8 billion industry globally, comprised mainly of industrial robots for welding, painting and assembly line tasks.
- ▶ Funding for robotics research has increased by 50 percent or more in recent years at several select universities in North America.



inside asimo

Head/Eyes

ASIMO "sees" the world around it with two camera eyes. These cameras allow ASIMO to visually map its environment, understand and avoid stationary and moving objects, and recognize unique faces. Using both cameras together, ASIMO sees stereoscopically, just like humans, and can accurately calculate the distance between itself and objects.

Neck

ASIMO can freely and independently move its head to follow moving objects and to look in the direction of a detected sound.

Backpack

ASIMO's backpack contains custom-built processing systems that control all movement. ASIMO can be controlled through wireless signals from a computer operator or through voice and hand signal commands that the robot can independently process and carry out.

Body

ASIMO's body is made of a magnesium alloy frame covered with a plastic resin, which makes ASIMO very durable and light in weight.

Mid-Section

ASIMO's mid-section contains a rechargeable 40V/10AH nickel metal hydride (Ni-MH) battery that powers ASIMO for approximately 30 minutes. At around 17 pounds, ASIMO's battery is its single heaviest component. The placement of this battery helps ASIMO maintain its center of gravity when using its real-time, flexible-walking technology.

Arms

ASIMO's advanced walking technology allows ASIMO to walk continuously while freely gesturing and moving its arms. The five joints in each of ASIMO's arms provide ASIMO with a wide range of upper limb movement and allow ASIMO to move its arms at its side within a 105-degree angle.

Hands

ASIMO's hands currently have a grasping force of 1.1 pounds. Its four fingers and opposable thumb on each hand allow ASIMO to grasp objects such as a newspaper or cell phone and to shake hands with people.

Hips

Sophisticated hip joints allow ASIMO to walk continuously while changing directions at any time. Intelligent, flexible-walking technology gives ASIMO stability in response to sudden movements.

Legs/Feet

ASIMO's bipedal walking technology features a Prediction Movement Control. ASIMO can predict its next movement in real time and shift its center of gravity in anticipation. By creating walking patterns, changing its foot placement and turning angles at will, ASIMO can walk smoothly and naturally in virtually any direction. ASIMO can adjust its stride and speed freely and has a walking speed of up to 1 mile per hour.

1993-1997

Adding a head and body to the legs

In attaching an upper half of the body to the legs, Honda finally created its first true prototype robot, named P1. Standing 6 feet 2 inches tall and weighing 386 lbs, P1 had a very rugged appearance.

The next prototype, P2, resulted in more advanced walking abilities, and a much more people-friendly design. P2 could even maintain its balance when firmly pushed while standing still.

The P3 prototype model was even more compact than P2, standing 5 feet 2 inches tall, and weighing 287 lbs. Although more fluid and agile than P2, P3 still had to stop and shift position to change direction.

2000

Achieving human-like movement

Honda introduced ASIMO to the world in October 2000. Standing just four feet tall and weighing 115 lbs, ASIMO can walk forward and backward, climb and descend stairs, balance easily on one foot and make turns while walking.

ASIMO's deliberate size allows it to be useful in real world environments, such as helping around the home, operating light switches and door knobs, and working at tables and desks. ASIMO's people-friendly size makes it easier to communicate with humans and allows it to operate freely in the human living space.



Visit www.asimo.honda.com

to learn more about ASIMO in North America, to view movie clips, and more!