

HUMANOID ROBOTS - DESIGN AND PERFORMANCE

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ABSTRACT: In this material you will be introduced to "humanoid robots - design and performance" aesthetics and everyday performance. A humanoid robot is a robot that resembles the shape of the human body. The design can be for functional purposes, such as interaction with tools and human environments, for experimental purposes, such as the study of bipedal locomotion or for other purposes.

KEYWORDS: humanoid robot, aesthetics.

1. Introduction

A robot is a system composed of several elements: mechanics, sensors and actuators and steering mechanisms. The mechanic determines the appearance of the robot and the possible movements during operation. Sensors and actuators are used to interact with the system environment. The objective mechanism ensures that the robot successfully achieves its objective, for example by evaluating the sensor information. Humanoid robots are now used as research tools in many fields of science. Researchers are studying the structure and behavior of the human body to build humanoid robots. On the other hand, try to simulate the human body to better understand it. Human cognition is a field of study focused on how people learn from sensory information to acquire perceptual and motor skills. This knowledge is used to develop computational models of human behavior that are refined over time.



Fig. 1. Sophia Robot

2. Current stage

Types of humanoid robots:

Sophia Robot: She is one of the most famous humanoid robots and has been granted the citizenship of Saudi Arabia, becoming the first citizen robot in the world. It was developed by Hanson Robotics, a Hong Kong company founded by Dr. David Hanson in 2013. It is a robot modeled after actress Audrey Hepburn. He is one of the most advanced humanoid robots in the world, with an integrated neural formula and constantly learns from everything around him and around him. Unlike other robots, Sophia is endowed with artificial intelligence, capable of facial recognition and visual data processing. The Sophia robot is capable of certain conversations because it can answer certain questions.

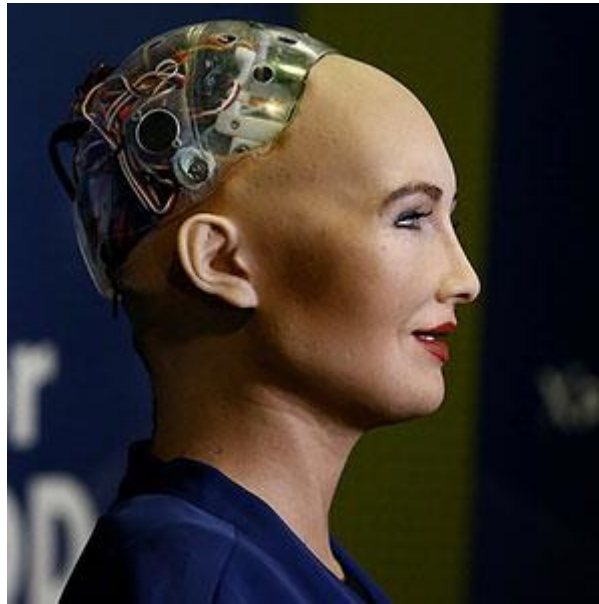


Fig. 2. Sophia Robot - details

Pepper Robot: He is one of the most advanced humanoid robots in the world, with an integrated neural formula and constantly learns from everything around him and around him. Unlike other robots, Sophia is endowed with artificial intelligence, capable of facial recognition and visual data processing. The Sophia robot is capable of certain conversations because it can answer certain questions.



Fig. 3. Pepper Robot

Erica Robot: Erica, the humanoid robot, will become the world's first TV presenter as she is filmed by Japanese television. It is a powerful robot that can turn its head where it hears voices and can identify who asks a question. It has one of the most advanced speech synthesis systems ever developed. Created by Hiroshi Ishiguro of Osaka University, she looks like a 23-year-old girl.



Fig. 4. Erica Robot

Reem Robot: The robot was created by PAL Robotics to perform certain activities, to provide information, to have conversations and even to give presentations in several languages. Has the ability to speak 9 foreign languages, but also facial recognition. It's the humanoid robot that's being used as a cop in the Dubai Mall. Until now, it has also been used in museums, fairs, shops and even airports.



Fig. 5. Reem Robot

ICub robot: It is the humanoid robot created by the Italian Institute of Technology of Genoa that has the ability to move its arms, head and legs. He has tactile sensors and can hear and see, and artificial intelligence helps him interact with others.

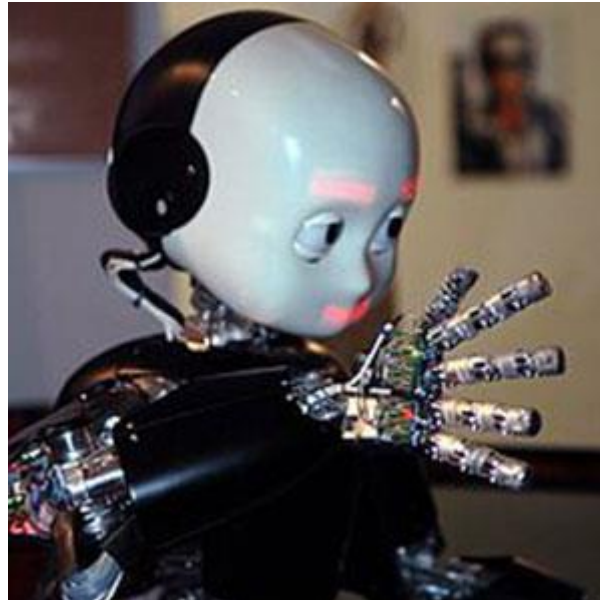


Fig. 6. ICub robot

Although the original goal of humanoid research was to better build orthoses and prostheses for human beings, knowledge was transferred between the two disciplines. Examples include motorized leg prostheses for neuromuscular deficiencies, ankle-foot orthosis, realistic biological leg prosthesis, and forearm prosthesis.

In addition to research, humanoid robots are being developed to perform human tasks, such as personal care, through which they should be able to help the sick and elderly, as well as dirty or dangerous jobs. Humanoids are also suitable for some procedure-based vocations, such as reception desk administrators and car production line workers. In essence, because they can use tools and use equipment and vehicles designed for human form, humanoids could theoretically perform any task that a human being could perform, as long as they have software. However, the complexity of this is immense.

With the increase in speed and the use of dynamic gait, external sensors are needed, mainly the video camera, which can transmit data about the environment and the ground.

Image processing and the complexity of control algorithms challenge very long computational times, which limit travel speeds.

Experts believe that the efficiency of visual sensors and image processing will increase dramatically in the near future, as it is the subject of assiduous research in many fields.

Handling and gripping

A humanoid robot must interact with its environment. An important role in this interaction belongs to the handling functions, which serve to catch, transport and handle objects.

Not all humanoid robots need sophisticated arms and hands, many can handle clamps with two jaws, which mean and open, or hands with 2-3 simpler fingers.

Utah / MIT hand

It is built of 3 fingers with 4 degrees of mobility and a thumb with another 4 degrees of mobility. The joints are operated with the help of high-speed pneumatic artificial muscles by means of strong polyethylene tendons.

For each joint, 2 muscles and 2 tendons are used, resulting in a total of 32 muscles and 32 tendons.

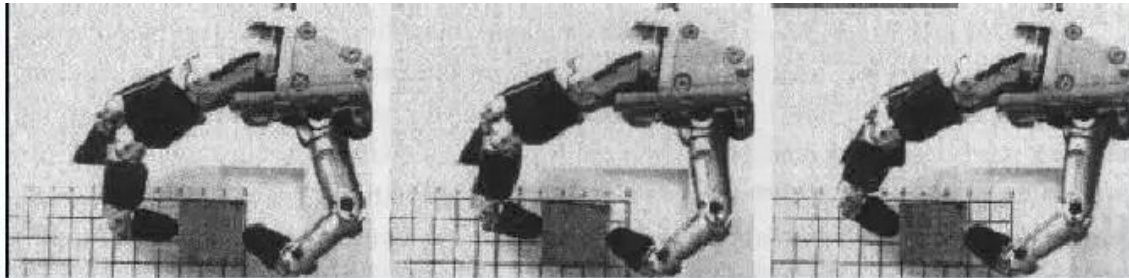


Fig. 7. Utah / MIT hand

3. Conclusions

According to specialists from the Universities of Bristol and Essex in the UK, humanoid robots will play an increasingly important role in human life, being designed to have as many specific human abilities as possible and to play the role of "friend of the future". They managed to create the first humanoid robot that can reproduce in real time various complex facial expressions. Applications of humanoid robots in large areas of human life regarding human assistance, psycho-motor recovery, rescue in disaster situations, exoskeleton, entertainment with advanced human-robot interaction, leads to the development of "sociable" robots that can communicate in a way that supports the natural ways of human communication.

The perspectives of the humanoid robot evolution are to play a role more and more important in human life and to become his "the future friend". Thus, they will be capable to save the human's life or to win a football game against him. Moreover, they will be capable to chat to humans, to maintain the household clean or to dance and entertain the humans. All these in order for the human-robot interaction to be friendly.

The robot evolution has just begun and in the near future we will see incredible achievements.

4. References

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