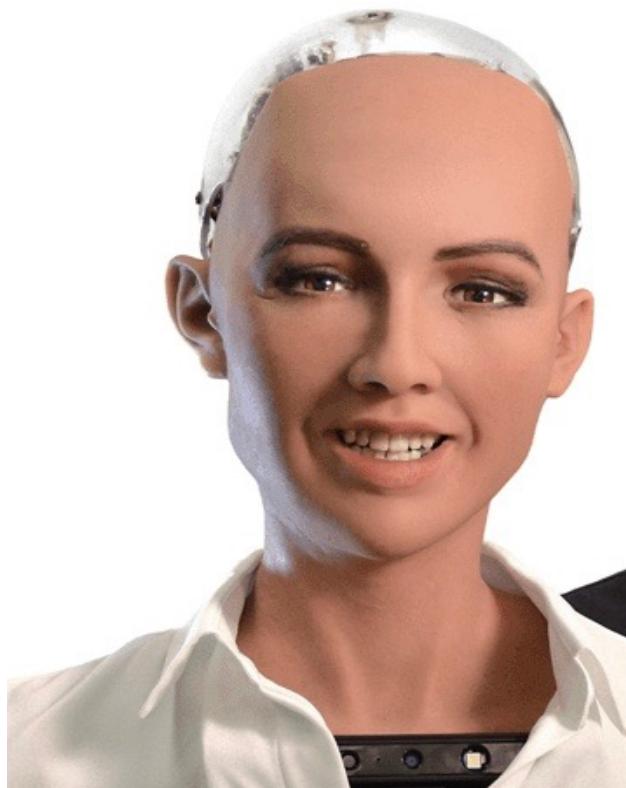


A case study on

Topic:- Sophia

(A Humanoid Robot)



Made by-

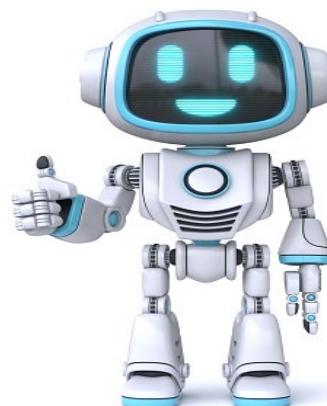
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What is a robot?

A robot is a machine—especially one programmable by a computer—capable of carrying out a complex series of actions automatically. It is defined as any automatically operated machine that replaces human effort, though it may not resemble human beings in appearance or perform functions in a humanlike manner.



Types of Robots:

- Mobile Robots
- Stationary Robots
- Autonomous Robots
- Augmenting Robots

What is Robotics?

Robotics is a branch of Science or Engineering that deals with designing or building of robots. Simply, Robotics is defined as “The study of Robots”. The aim of robotics is to design an efficient robot.

First use of words “Robot and Robotics”

The word ‘robot’ was introduced to the public by Czech writer ‘Karel Capek’ in his play R.U.R(Rossum’s Universal Robots), published in 1920. The play begins in a factory that makes artificial people called robots. Capek was reportedly several times a candidate for the Nobel Prize for his works.



Karel Capek



The word ‘robotics’, used to describe this field of study, was coined accidentally by the Russian-born American Scientist and Science fiction writer, Isaac Asimov in 1940s.

4R's of Robotics

For a robot to have the best level of success 4 R's were created to ensure the best output for the robot:-

1. Robot:- The type of robot that will be used in the particular situation needs to be addressed before any tasks can be completed.
2. Ranking:- The actions that a robot will need to complete have to be ranked to help the robot determine what it will do first or next.
3. Relevance:- If a task is given to the robot, it needs to determine if that task meets the requirements of the tasks that it has been programmed to complete.
4. Results:- Looking at outcomes of the tasks completed to make sure that the robot is as effective as it can be.



Laws of Robotics

- Asimov proposed the three “Law’s of Robotics”.
1. Law 1:- A robot may not injure a human being or through inaction, allow a human being to come to harm.
 2. Law 2:- A robot must obey orders given to it by human beings, except where such orders would conflict with the first law.
 3. Law 3:- A robot must protect its own existence as long as such protection does not conflict with the first law.

Three Laws of Robotics



How do Robots work?

A robot is any moving machine that can be programmed to perform tasks and gather information from its surroundings. Robots work from a central microprocessor that controls their movements, they also have sensors for examining the environments and power sources.

The robot control loop

Speech, Vision

Acceleration,

Temperature

Position ,Distance

Touch, Force

Magnetic field ,Light

Sound ,

PositionSense

Task planning

Plan Classification

Learn

Process data

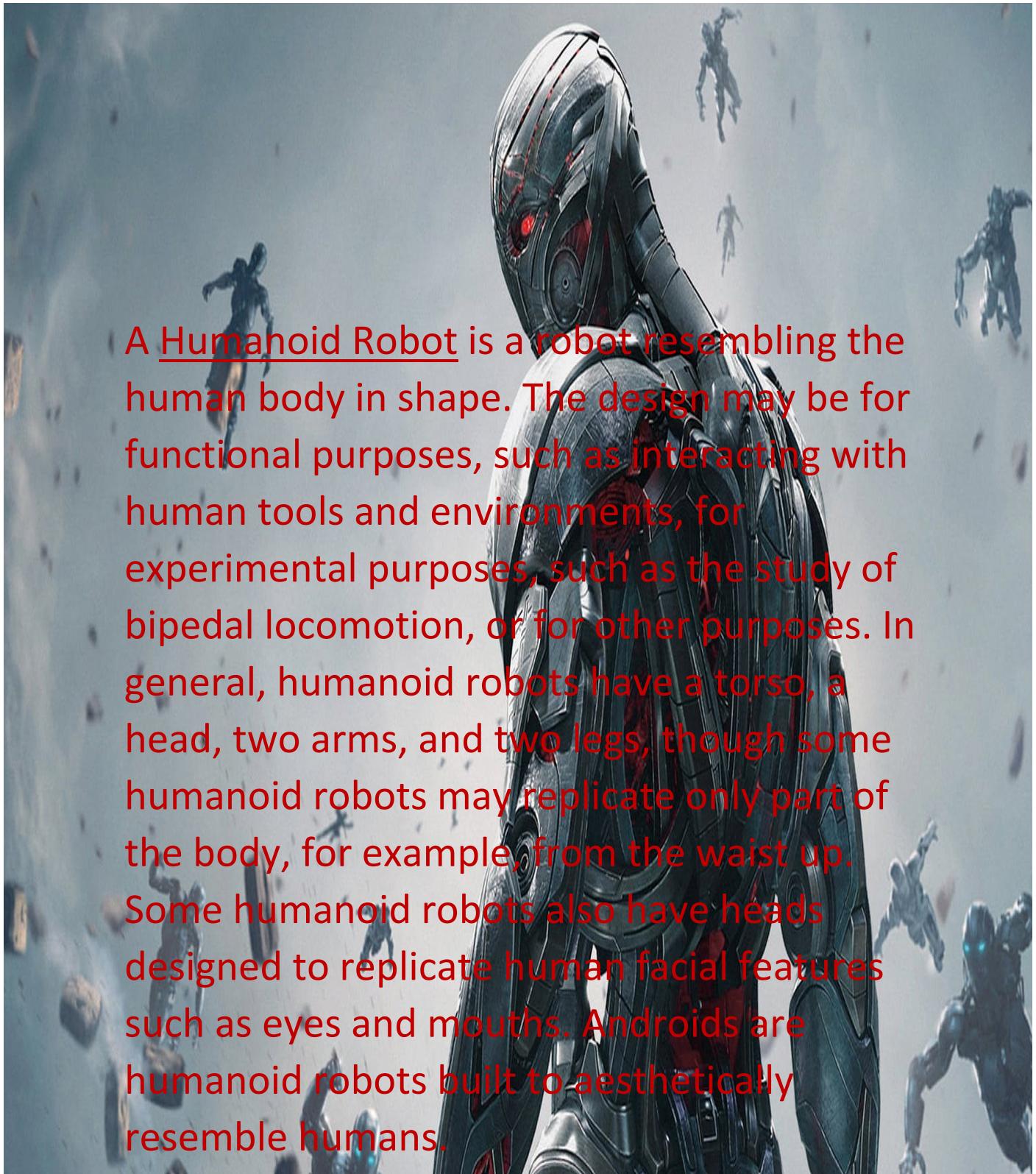
Path planning

Motion planning



Output information Move, Speech
Text, Visuals Wheels Legs
Arms Tracks

Humanoid Robot



A Humanoid Robot is a robot resembling the human body in shape. The design may be for functional purposes, such as interacting with human tools and environments, for experimental purposes, such as the study of bipedal locomotion, or for other purposes. In general, humanoid robots have a torso, a head, two arms, and two legs, though some humanoid robots may replicate only part of the body, for example, from the waist up. Some humanoid robots also have heads designed to replicate human facial features such as eyes and mouths. Androids are humanoid robots built to aesthetically resemble humans.

History

The concept of a humanoid robot originated in many different cultures around the world. Some of the earliest accounts of the idea of humanoid **automata** date to the 4th century BCE in Greek mythologies and various religious and philosophical texts from China. Physical prototypes of humanoid automata were later created in the Middle East, Italy, Japan, and France.

China:-

In the 3rd century BCE, a **Taoist** philosophical text called the **Liezi**, written by Chinese philosopher **Lie Yukou**, detailed the idea of a humanoid automaton. The text includes mention of an engineer named Yan Shi who created a life-size, human-like robot for the fifth king of the Chinese Zhou Dynasty, **King Mu**.^[3] The robot was primarily constructed of leather and wood. It was capable of walking, singing, and moving all parts of its body.

Italy:-



Model of Leonardo's robot with inner workings.

In the 1400s, **Leonardo da Vinci** conceptualized a complex mechanical robot clad in a suit of armour, capable of sitting, standing, and independently moving its arms.^[6] The entire robot was operated by a system of pulleys and cables.

France:-

In the 18th century, French inventor **Jacques de Vaucanson** created a significant humanoid automaton called *The Flute Player*. This wooden, human-sized robot was capable of playing various melodies with the flute. It consisted of a system of bellows, pipes, weights, and other mechanical components to simulate the muscles necessary to play the flute.

Sophia- A humanoid Robot

Hanson Robotics' most advanced human-like robot, Sophia, personifies the dreams for the future of AI. As a unique combination of Science, Engineering and artistry, Sophia is simultaneously a human-crafted Science fiction character depicting the future of AI and robotics, and a platform for advanced robotics and research.

The character of Sophia captures the imagination of global audiences. She is the world's first robot innovation Ambassador for the United Nations Development Programme. Sophia is now a household name, with appearances on the Tonight Show and Good Morning Britain, in addition to speaking at hundreds of conferences around the world.

Sophia is also a framework for cutting edge robotics and AI, particularly for understanding human-robot interactions and their potential service and entertainment applications. For example, she has been used for research as part of the loving AI project, which seeks to understand how robots can adapt to users' need through intra and interpersonal development.

History of Sophia

Sophia was first activated on February 14, 2016. The robot, modelled after the ancient Egyptian [Queen Nefertiti](#), [Audrey Hepburn](#), and its inventor's wife, Amanda Hanson, is known for its human-like appearance and behaviour compared to previous robotic variants. As of 2018, Sophia's architecture includes scripting software, a chat system, and [OpenCog](#), an AI system designed for general reasoning. Sophia imitates human gestures and facial expressions and is able to answer certain questions and to make simple conversations on predefined topics (e.g. on the weather). Sophia uses [speech recognition](#) technology from [Alphabet Inc.](#) (the parent company of [Google](#)) and is "designed to get smarter over time". Its [speech synthesis](#) ability is provided by [CereProc's text-to-speech](#) engine, and also allows it to sing. Sophia's intelligence software is designed by Hanson Robotics. The AI program analyses conversations and extracts data that allows it to improve responses in the future.

Hanson designed Sophia to be a suitable companion for the elderly at nursing homes, or to help crowds at large events or parks. He has said that he hopes that the robot can ultimately interact with other humans sufficiently to gain [social skills](#). Sophia is marketed as a "social robot" that can mimic social behaviour and induce feelings of love in humans.

Sophia has at least nine robot humanoid "siblings" who were also created by [Hanson Robotics](#). Fellow Hanson robots are Alice, [Albert Einstein Hubo](#), [BINA48](#), Han, Jules, Professor Einstein, Philip K. Dick Android, Zeno, and Joey Chaos. Around 2019–20, Hanson released "Little Sophia" as a companion that could teach children how to code, including support for Python, Blockly, and Raspberry Pi.

Features of Sophia

A [computer vision](#) algorithm processes input from cameras within Sophia's eyes, giving Sophia visual information on its surroundings. It can follow faces, sustain eye contact, and recognize individuals. It can process speech and have conversations using a natural language subsystem. Around January 2018, Sophia was upgraded with functional legs and the ability to walk. CNBC has commented on Sophia's "lifelike" skin and its ability to emulate more than 60 facial expressions.

Sophia is conceptually similar to the computer program [ELIZA](#), which was one of the first attempts at simulating a human conversation. The software has been programmed to give pre-written responses to specific questions or phrases, like a [chatbot](#). These responses are used to create the illusion that the robot is able to understand conversation, including stock answers to questions like "Is the door open or shut?" In 2017 Hanson Robotics announced plans to open Sophia to a [cloud environment](#) using a decentralized [blockchain](#) marketplace.

David Hanson has said that Sophia would ultimately be a good fit to serve in healthcare, customer service, therapy and education. In 2019, Sophia displayed the ability to create drawings, including portraits.

Role played by Computer Science Engineering

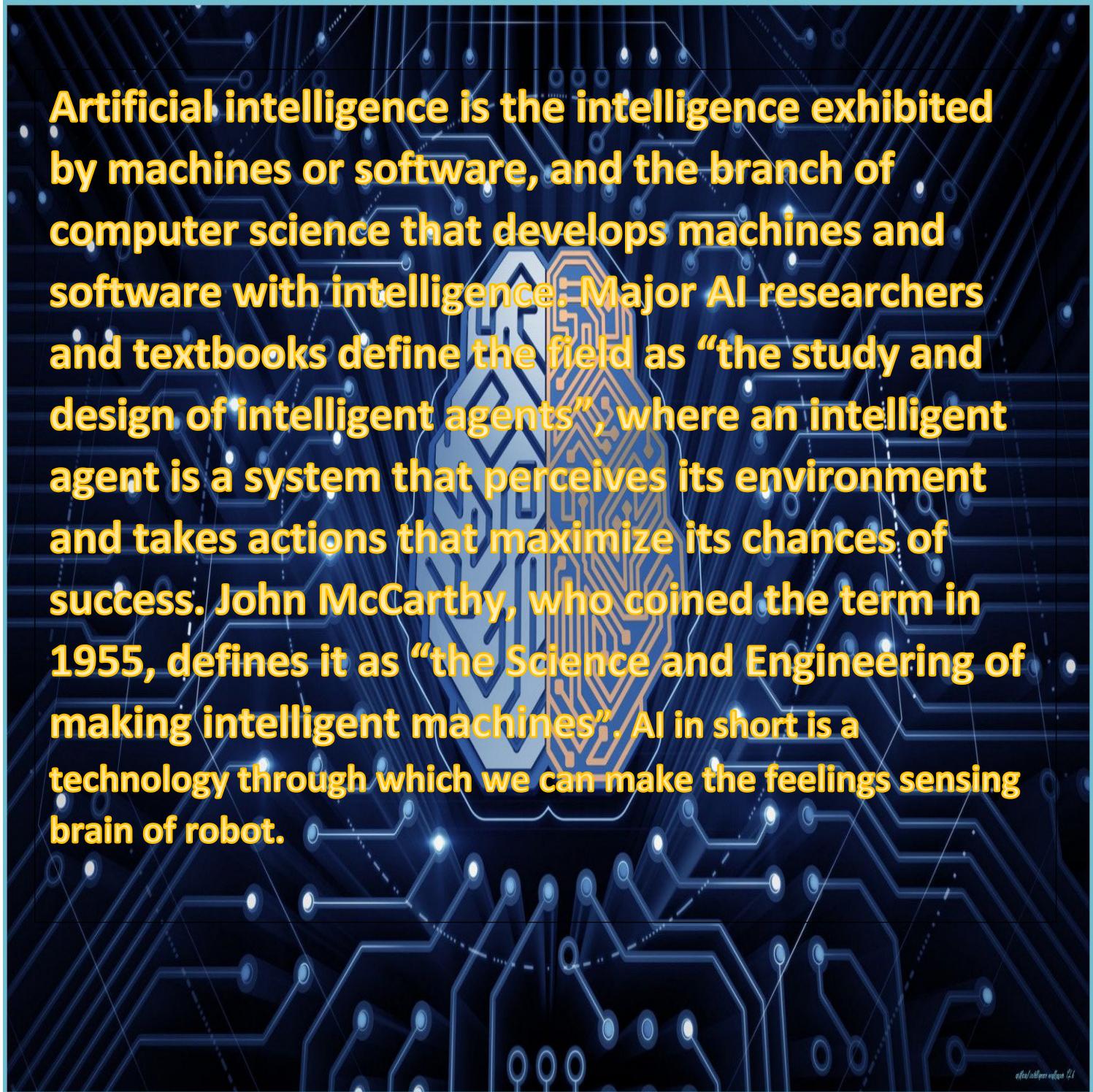
Programming:- It is the basic need for the development of robots. As all body parts of robot require programming to get synched with command given to a robot.

Computer vision:- Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information. If AI enables computers to think, computer vision enables them to see, observe and understand.

Computer vision works much the same as human vision, except humans have a head start. Human sight has the advantage of lifetimes of context to train how to tell objects apart, how far away they are, whether they are moving and whether there is something wrong in an image.

Computer vision trains machines to perform these functions, but it has to do it in much less time with cameras, data and algorithms rather than retinas, optic nerves and a visual cortex. Because a system trained to inspect products or watch a production asset can analyse thousands of products or processes a minute, noticing imperceptible defects or issues, it can quickly surpass human capabilities.

Artificial Intelligence



Artificial intelligence is the intelligence exhibited by machines or software, and the branch of computer science that develops machines and software with intelligence. Major AI researchers and textbooks define the field as “the study and design of intelligent agents”, where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success. John McCarthy, who coined the term in 1955, defines it as “the Science and Engineering of making intelligent machines”. AI in short is a technology through which we can make the feelings sensing brain of robot.

Role played by Mechanical Engineering

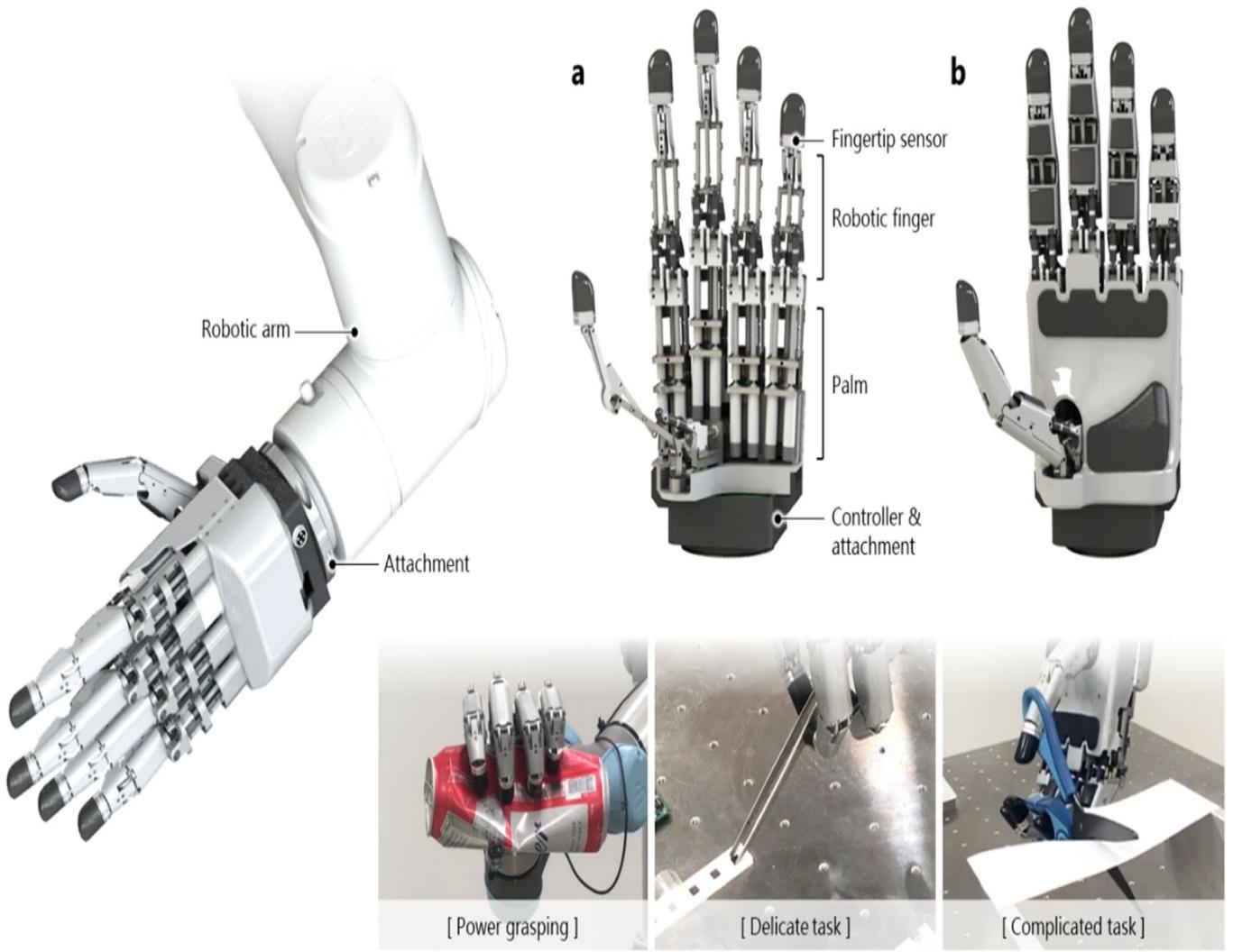


Mechanical engineering is the branch of engineering that deals with energy and its conversion into useful work. This includes production of machines, engines, power tools, air conditioners, heating and cooling systems, wind turbines, farm equipment, robotics and more.

Mechanical engineers design the robot's structure, joint mechanism, bearing, heat transfer characteristics, etc.

This engineering actually focuses on the motion of robots. The movement of arms, legs and joints, etc.

Also the motion of eyeballs and neck of the robot.

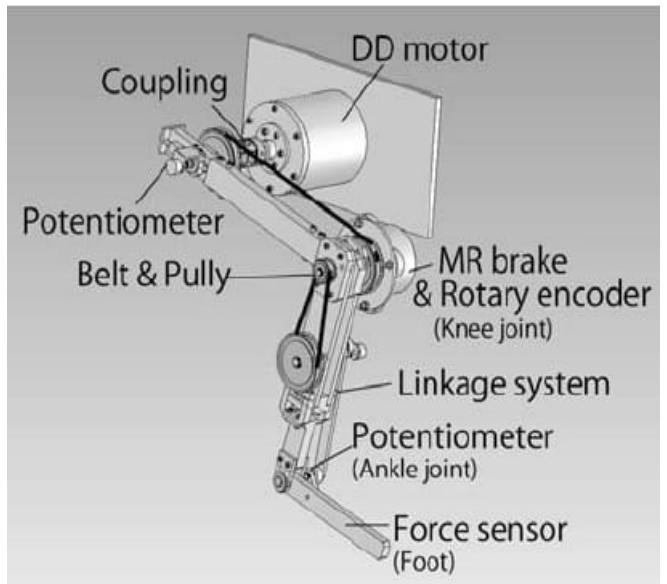


c Integration of the robotic hand

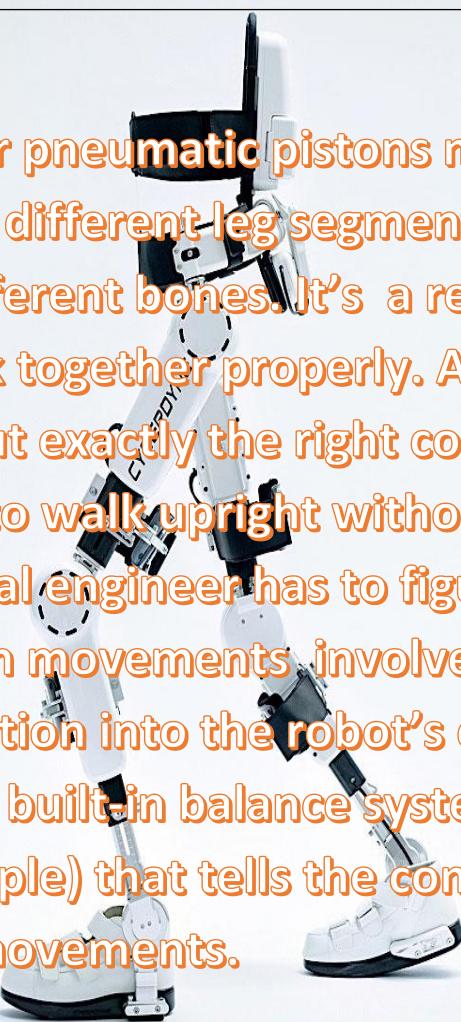
d Various grasp & manipulation tasks

A humanoid robot must possess a hand very similar to human hands, use of prosthetic hands for this purpose is more suitable.

To give these anthropomorphic hands, the feel and flexibility of a human hand, they are generally made out of soft material coating and are tendon driven at the fingers with other joints like wrists and elbow being normal revolute joints. The skeletal model of these hands carries all of the actuation, perception, components like force and touch sensing capabilities for the wrist and elbow.



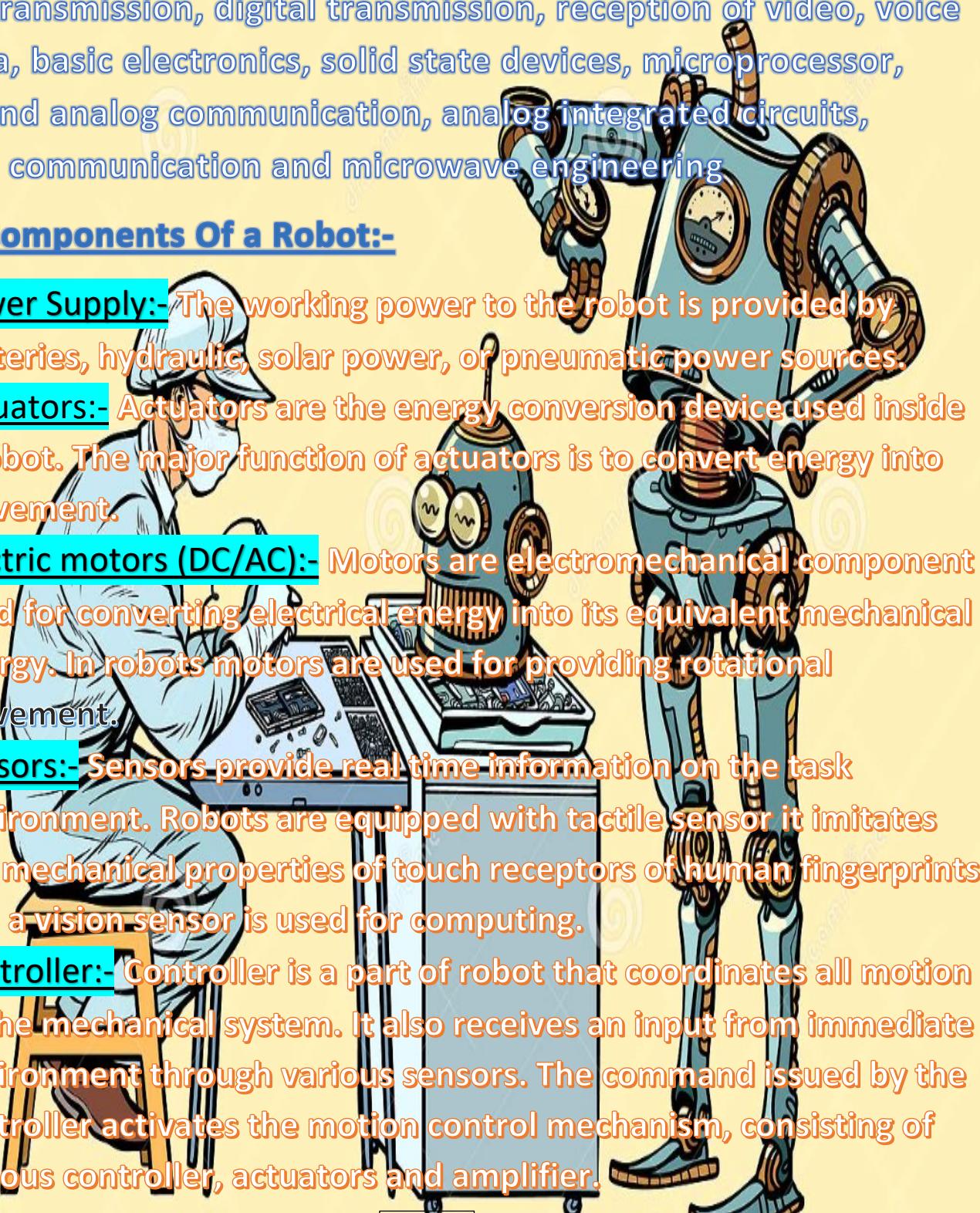
Typically, hydraulic or pneumatic pistons move robot legs. The pistons attach to different leg segments just like muscles attach to different bones. It's a real trick getting all these pistons to work together properly. As a baby, our brain had to figure out exactly the right combination of muscle contractions to walk upright without falling over. Similarly, a mechanical engineer has to figure out the right combination of piston movements involved in walking and program this information into the robot's computer. Many mobile robots have a built-in balance system(a collection of gyroscopes, for example) that tells the computer when it needs to correct its movements.



Role played by Electronics and Telecommunication Engineering

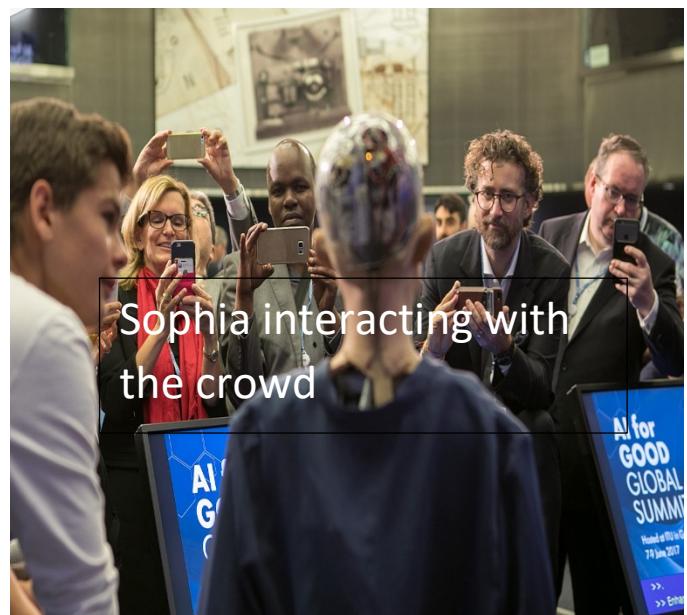
Electronics and Telecommunication Engineering branch deals with analog transmission, digital transmission, reception of video, voice and data, basic electronics, solid state devices, microprocessor, digital and analog communication, analog integrated circuits, satellite communication and microwave engineering.

Basic Components Of a Robot:-

- 
- **Power Supply:**- The working power to the robot is provided by batteries, hydraulic, solar power, or pneumatic power sources.
 - **Actuators:**- Actuators are the energy conversion device used inside a robot. The major function of actuators is to convert energy into movement.
 - **Electric motors (DC/AC):-** Motors are electromechanical component used for converting electrical energy into its equivalent mechanical energy. In robots motors are used for providing rotational movement.
 - **Sensors:**- Sensors provide real time information on the task environment. Robots are equipped with tactile sensor it imitates the mechanical properties of touch receptors of human fingerprints and a vision sensor is used for computing.
 - **Controller:**- Controller is a part of robot that coordinates all motion of the mechanical system. It also receives an input from immediate environment through various sensors. The command issued by the controller activates the motion control mechanism, consisting of various controller, actuators and amplifier.



Sophia at Tech Fest 2017, IIT Bombay



Social Events

Sophia has been interviewed in the same manner as a human, striking up conversations with hosts. Some replies have been nonsensical, while others have impressed interviewers such as [60 Minute's Charlie Rose](#). In a piece for CNBC, when the interviewer expressed concerns about robot behaviour, Sophia joked that he had "been reading too much [Elon Musk](#). And watching too many Hollywood movies". Musk tweeted that Sophia should watch [The Godfather](#) and asked "what's the worst that could happen?" [Business Insider](#)'s chief UK editor Jim Edwards interviewed Sophia, and while the answers were "not altogether terrible", he predicted that Sophia was a step towards "conversational artificial intelligence". At the 2018 [Consumer Electronics Show](#), a [BBC News](#) reporter described talking with Sophia as "a slightly awkward experience".

On October 11, 2017, Sophia was introduced to the [United Nations](#) with a brief conversation with the United Nations Deputy Secretary-General, [Amina J. Mohammed](#).



Sophia having interview
with Will Smith

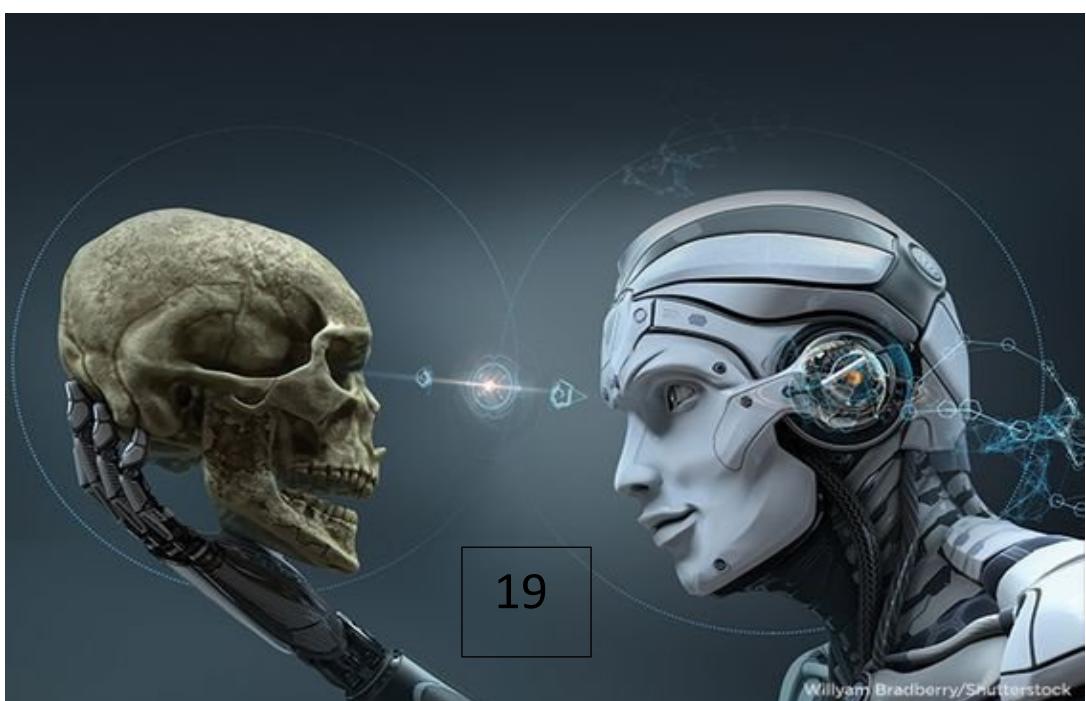


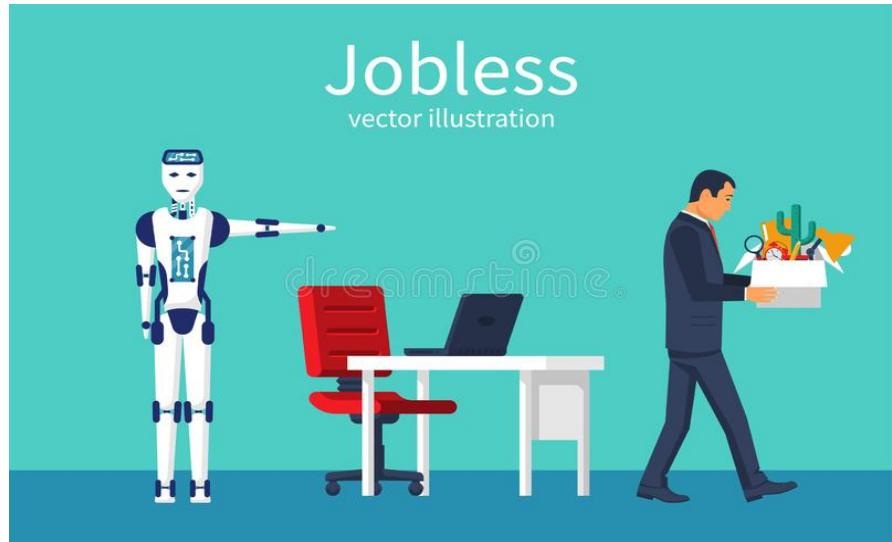
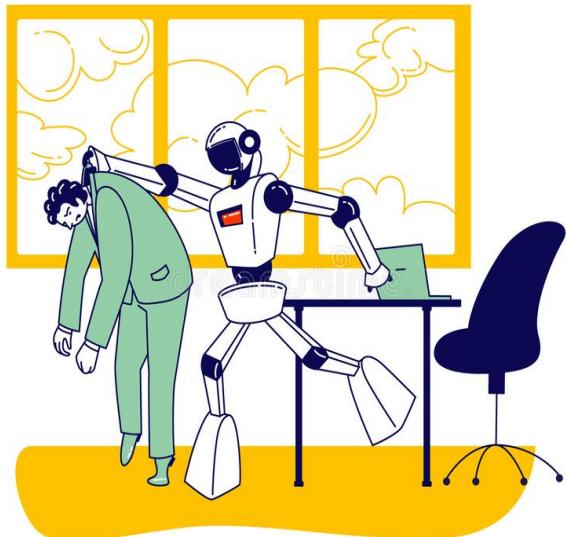
Sophia interacting with world
after getting Saudi Arabian
Citizenship.

On October 25, at the Future Investment Summit in [Riyadh](#), the robot was "granted [Saudi Arabian](#) citizenship", becoming the first robot ever to have a nationality, described as a [publicity stunt](#). This attracted controversy as some commentators wondered if this implied that Sophia could vote or marry, or whether a deliberate system shutdown could be considered murder. Social media users used Sophia's citizenship to criticize [Saudi Arabia's human rights record](#). In December 2017, Sophia's creator David Hanson said in an interview that Sophia would use its citizenship to advocate for women's rights in its new country of citizens.

Future Developments:-

- Humanoid robots, while being one of the smallest groups of service robots in the current market, have the greatest potential to become the industrial tool of the future.
- Currently, humanoid robots are excelling in the medical industry, especially as companion robots.
- NASA is using its Valkyrie robot for similar tasks, albeit on future missions to Mars. Valkyrie is a 6-2 humanoid robot weighing 300 lb.
- Psychosensory electronic skin technology for future AI and humanoid development
- Scientists have developed electronic skin technology for robots or electronic devices to feel pain through sense of touch. Expected to be applied in humanoid that needs 5 human senses and patients wearing prosthetic hands.



A background illustration depicting a man in a grey shirt and black pants working at a desk, with a large white robot standing behind him. In the foreground, another man in a dark suit is shaking hands with a white robot. A clock is visible on the wall above the desk.

Disadvantages:-

- People are afraid that robots will replace their jobs.
- If this is so then the economy will be deprecated.
- Advanced robots are making humans lazy.
- Many fear that robots can take over mankind

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- College Library
- Internet

THANK you!

