I'm not a robot

Founded in 1916 and headquartered in Munich, Germany, BMW (Bayerische Motoren Werke AG) has grown into a global titan, selling over 2.45 million vehicles in 2024 and generating revenues exceeding 154billion. Geographically, China is... An intelligence agency functions as the nervous system of a nations defense infrastructure. It plays a crucial role in gathering and relaying critical information about potential threats to national security, enabling law enforcement agencies and... A law firm, like any company, is a business entity that provides legal services to its clients, from individuals to corporations and even governments. Law firms can vary in size from sole practitioners to large multinational law firms. Smaller or... Microsoft Windows is the leading operating system for desktop computers and laptops, commanding a market share of approximately 72%. Microsoft Office 365 ranks as the worlds second most popular office suite, holding a 30% share. Similarly, Azure... 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Financial analytics provide detailed insights into the financial performance of a company. This includes the companys revenue, profits, operational efficiency, liquidity, solvency, and other finance-related transactions. It helps you answer... If you like the idea of working for yourself, this is the best time to experiment with entrepreneurship. While you cannot start a business that makes you rich overnight, you can still earn a decent amount of money by working hard and being smart... With over $55.7 billion in annual revenue, 160,000+ employees, and 29,000+ consulting experts, Oracle Corporation stands as one of the most dominant and influential enterprise technology giants in the world. Oracles core strength lies in its... Established in 1987 through the merger of Louis Vuitton and Mot Hennessy, LVMH has grown into the worlds largest luxury goods conglomerate, renowned for its prestigious brands and exceptional quality. I have conducted a comprehensive...Download the Testbook APP & Get Pass Pro Max FREE for 7 Days10,000+ Study NotesRealtime Doubt Support71000+ Mock TestsRankers Test Series+ more benefitsDownload App Now The components of a robot are the body/frame, control system, manipulators, and drivetrain . What are the four major components of industrial robots? The four main parts of an industrial robot are the manipulator, the controller, the human interface device, and the power supply . The manipulator is the arm and can move in various different directions. What are the main components of robot? Central Processing Unit. The central processing unit (CPU) acts as the brain of the robot. Sensors. Sensors are the powerhouse of a robots feedback mechanism. Actuators. End-Effectors. Power Supply. A Program. What are the four basic configurations for robots? In terms of robotic movement capabilities, there are several common robotic configurations: vertically articulated, cartesian, SCARA, cylindrical, polar and delta . What are the types of robot? 1) Pre-Programmed Robots. Pre-programmed robots operate in a controlled environment where they do simple, monotonous tasks. 2) Humanoid Robots. Humanoid robots are robots that look like and/or mimic human behavior. 3) Autonomous Robots. 4) Teleoperated Robots. 5) Augmenting Robots. What is the most famous robot? Optimus Prime Transformers. View in gallery via moviemorgue.wikia.com. R2-D2 Star Wars. View in gallery via hellogiggles.com. C-3PO Star Wars. B-9 Lost in Space. Robby the Robot Forbidden Planet. Gort The Day the Earth Stood Still. The Stepford Wives. WALL-E. What is the main function of robot? They may recognize people or objects, talk, provide companionship, monitor environmental quality , respond to alarms, pick up supplies and perform other useful tasks. General-purpose robots may perform a variety of functions simultaneously or they may take on different roles at different times of day. What are the three characteristics of a robot? Sensing First of all your robot would have to be able to sense its surroundings. Movement A robot needs to be able to move around its environment. Energy A robot needs to be able to power itself. How many parts does a robot have? A simple robot with three degrees of freedom can move in three ways: up & down, left & right, and forward & backward. Many industrial robots in factories today are six axis robots. The end effector connects to the robots arm and functions as a hand. What are the 4 types of robots? Articulated Robots. An articulated robot is the type of robot that comes to mind when most people think about robots. SCARA Robots. Delta Robots. Cartesian Robots. How you can classify robots explain a classification of robot? On the basis of work envelope geometry, robots can be classified as Cartesian, Cylindrical, Spherical, Articulated, SCARA, and Delta . It is the most commonly used robot type in the industries. The linear movement of cartesian elements gives the robot a rectangular or cube shaped workspace. What is common robot configuration? One of the major factors which determines how an industrial robot will move and what limits its workspace is its robot configuration. There are six major types of robot configurations: Cartesian, Cylindrical, Spherical, Selective Compliance Articulated Robot Arm (SCARA). Articulate, and Delta (Parallel) . What are the 5 types of robots? A simpler, more complete definition of robotic types can be narrowed down to five types: Cartesian, Cylindrical, SCARA, 6-Axis and Delta . Each industrial robot type has specific elements that make them best-suited for different applications. The main differentiators among them are their speed, size and workspace. What is robot in simple words? A robot is a machine that can move and do certain tasks . Robots are controlled by a computer program or electronic circuitry. They may be directly controlled by humans. Most robots do a specific job, and they do not always look like humans. They can come in many forms. What are the three main classes of robots? There are three types of robotic systems the manipulation robotic system, the mobile robotic system and the data acquisition and control robotic system . What is the smartest robot? Sophia in 2018 Manufacturer Hanson Robotics Inventor David Hanson Country China Saudi Arabia (citizen) Year of creation 2016 Skip to main content Skip to footer wpDiscuzWould love your thoughts, please comment.x Ever wondered, What are the main components of a robot? Let's clear that up for you!While robots may seem simple when you see them in action, theyre a deceivingly complex web of interacting parts governed by powerful AI.In this article, well examine the key components that make these relentless mechanical companions tick.Well cover:What are the main components of a robot?The control systemThe power supplySoftware and programmingLets dive right in!What are the main components of a robot?Robots are incredibly complex machines with lots of moving parts. At their core, they're made up of several key components that allow them to function and carry out tasks.Let's break those down:Mechanical structures: The physical body and frame provide structure and support and determine the robot's shape, size, and mobility. The frame must be durable yet lightweight enough to allow smooth movements.Control system: Youve heard the comparisons between control systems and robot brains. Well, were going to do that again because the comparison is apt; the control system is where youll run the program, and its a powerful PLC (Programmable Logic Controller).Power supply: None of this would run without a bit of juice, right? Robots typically rely on electrical power units, but some systems incorporate hydraulic or pneumatic power sources depending on the specific industrial application.Software: Software dictates a robots behavior, running on the PLC. In recent years, AI advancements have made robotics more accessible, allowing even non-experts to program and interact with robots using intuitive, low-code interfaces. These developments have been key in making robots more adaptive and user-friendly across different applications.Mechanical structuresLets go into a bit more detail regarding the mechanical structures, as theyre pretty important:Links and joints: Robots need articulated arms and parts that can bend, rotate, and move. Joints connect the different rigid links, allowing free motion in certain planes. The configuration of links and joints impacts the robot's degrees of freedom and range of motion.Actuators and motors: Electric motors, hydraulics, or pneumatics create the forces to control the positioning of links and joints. Stronger actuators can be compared to stronger muscles, and they enable faster, more powerful actions.End effectors: These tools and attachments are the business end of a robot arm, allowing it to interact with objects and perform work. Common end effectors include grippers, welding tools, painting tools, and more specialized equipment.Control systemNow its time to get to the heart of the matter, and at the core of every robot lies a sophisticated control system responsible for coordinating all its movements and functions.Let's go into more detail:Powerful brain: The central processing unit (CPU) is the central hub, processing instructions and coordinating its actions. This computer calculates trajectories, monitors sensors, and relays commands to the various components. In industrial robotics, the CPU is typically referred to as a controller or PLC (Programmable Logic Controller) rather than simply a CPU.Precise controllers: Controllers and drives translate the CPU's digital signals into physical motions by regulating the flow of power to the robot's motors and actuators. They ensure that the robot moves precisely, coordinated, and efficiently.Senses on alert: Sensors and feedback systems provide the robot with awareness of its surroundings and its position and movements. From vision systems to force sensors, these inputs allow the control system to make real-time adjustments for optimal operation.Power supplyWhile not all industrial robots are major power hogs, most require a sturdy power supply to keep operating at full capacity. Without adequate power, these systems would grind to a halt, disrupting production lines and costing you significant amounts of money.These are the parts that make up these power supplies:Electrical power units: These serve as the backbone of an industrial robot's power supply. These units convert the incoming electrical current from the main power source into the appropriate voltage and current levels required by the robot's various components, such as motors, sensors, and control systems.Backup power sources: Were talking about generators or uninterruptible power supplies (UPS), which are essential for mission-critical applications or environments where power outages can have severe consequences. These redundant systems help ensure that the robot can continue operating or safely shut down in the event of a main power failure, minimizing disruptions and protecting valuable equipment and data.Software and programmingSoftware plays a pivotal role in the functionality of modern industrial robots. While the complex CPU (or PLC) can be thought of as the brain, its the software that acts as the robots mind and soul. Without solidly built software systems, robots would be little more than heavy mechanical paperweights.Lets explore this further:Versatile operating systems lie at the core: They provide the foundation for integration and communication between a robots hardware components, though these systems are often customized or proprietary depending on the application. These OS platforms provide a stable foundation for developing and deploying robotic applications.Programming languages drive the robots behavior: From low-level languages for precise control to high-level ones for rapid prototyping, a diverse array of options empowers developers to create sophisticated robotic programs tailored to specific industrial needs.User interfaces for total control: These bridge the gap between human operators and robotic systems. Well-designed UIs allow for intuitive programming, monitoring, and control of robots, optimizing operations and enhancing productivity on the factory floor. Thoughtful interface design is crucial for harnessing the full potential of these advanced machines.Summing upNow, you dont have to stand there dumbfounded when someone yells out, What are the main components of a robot?While it may seem that youd need a PhD to get a handle on the basics, its a bit simpler than it looks. Understanding the roles and functions of each component can help you understand these bots better and understand whether theyre right for your business.With the right knowledge and approach, you can harness industrial robotics' full potential and scale your operations to new heights.Next stepsReady to take your business to the next level of efficiency and productivity? RO1 by Standard Bots, the powerful six-axis collaborative robot arm, is the answer.Bang for your buck: RO1 delivers top-tier performance at half the cost of comparable robotic arms, making automation accessible to any business.Power up your output: With its impressive 18 kg payload capacity and best-in-class speed and precision, RO1 will significantly increase your production capabilities.Simplify automation: RO1's intuitive no-code interface and AI-powered capabilities, comparable to GPT-4, make programming and deployment simpler than ever, even for those without technical expertise.Prioritize safety: Rest easy knowing your team is protected with RO1's built-in safety features, including sensors, machine vision, and collision detection.Experience the RO1 difference firsthand with a risk-free 30-day trial. Contact our team today and discover how RO1 can transform your operations. In this article, I will show you how you can create a simple CRUD application using HTML, CSS, PHP, MySQL, and jQuery. Introduction The ever-changing world of technology continuously shapes the landscape of software engineering. With the rise of new paradigms, methods, and tools, A chatbot is a computer program that simulates human conversation, which could be in the form of text or speech. It uses What is Google AdSense? Google AdSense is a service of Google that places ads of businesses on different websites. These ads are In simple terms, an API (Application Programming Interface) is a mediator between two individual servers when they need to communicate with each Push notifications are pop messages sent by a specific mobile app or a website on a mobile device even when the app Google has recently launched a brand new programming language named Carbon or Carbon-Lang.It is an experimental language created to be a successor In 2022, it is increasingly important for individuals and businesses to have proficiency in programming languages. This is due to the increasing Machine learning is the branch of computer science that focuses on making computers learn by past experiences and by using a set Enjoy sharper detail, more accurate color, lifelike lighting, believable backgrounds, and more with our new model update. 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Your generated images will be more polished thanever.See What's NewExplore how consumers want to see climate stories told today, and what that means for yourvisuals.Download Our Latest VisualGPS ReportData-backed trends. Generative AI demos. Answers to your usage rights questions. Our original video podcast covers it allnow ondemand.Watch NowArtificial Intelligence (AI) and Robotics are undoubtedly two of the most promising fields of study right now. These two will certainly define the future of humanity.At present, we have ultra-modern machines with sleek designs and agile and highly capable bodies, which can perform a wide range of tasks with efficiency. We also have machine intelligence, which is literally revolutionizing the way we do most of our work.While AI is always an interesting subject to talk about, as we did countless times here on our website, lets talk about robots today. As you might know, there are many different ways in which one could differentiate robots. I am sure that you know at least some of them, but there is always more.Basically, robots can be divided into two broad categories:Based on their applicationsBased on their kinematics or locomotion.Below, we have only classified robots based on kinematics. Why is it so? Well, the application of any subject, especially robots, vaguely describes its characteristics. For instance, two different types of robots can perform the same job, yielding the same result.We have only mentioned major robotic types, and they are further subdivided based on kinematics.Did you know?The word robot originates from the Czech word robota, meaning forced labor. This term was introduced by Karel apek in his 1920 play R.U.R. (Rossums Universal Robots).Robotic Arms or Stationary Robots1. Cartesian RobotsImage Courtesy: Florian Schffer/ An implementation of the cartesian robotCartesian robots are perhaps the most common type of robot used for both industrial and commercial purposes. Sometimes known as gantry robots, they havethree linear axes, enabling them to move in straight lines, and they are mounted at right angles.The mechanical arrangement of cartesian robots is far simpler than most other stationary robots.They can be customized to meet specific application requirements. This includes modifications to the size of the workspace, payload capacity, and the type of end-effector (tool or gripper) attached to the robot.Applications: Manufacturing, assembly, packaging, material handling, and CNC (Computer Numerical Control) machining.2.Cylindrical RobotUnlike Cartesian robots that operate within a rectangular coordinate system (X, Y, and Z axes), Cylindrical Robots use a polar coordinate system to define their movements.Illustrated in the diagram, a cylindrical robot operates along three axes. On the Z axis, it rotates and moves vertically, and on the Y axis, it engages in linear motion. They are well-suited for tasks that involve rotational and circular motions.Sometimes, these cylindrical robots are mistakenly regarded as SCARA robots or vice versa. Even though their work mechanism is almost similar, both their structures and field of application are poles apart.Applications: Automotive manufacturing, electronics assembly, and tasks like welding seams on cylindrical structures.3.SCARA robotsGif Source: Wikimedia CommonsSCARA, which stands for Selective Compliance Assembly/Articulated Robot Arm, is widely preferred for assembly tasks, thanks to its straightforward and unobstructed mounting.SCARA Robots typically feature a serial architecture, where one base motor bears the load of all the other installed motors.The typical configuration includes a series of joints that allow for both rotational and translational movements.However, a drawback is their higher cost compared to traditional Cartesian robots. They also require sophisticated and complex software for operation.Applications: They are industrial robots commonly used in assembly processes, material handling, pick-and-place operations, and packaging.4. Parallel robotsParallel robots are more commonly known as Parallel manipulators, in which a bunch of machine-controlled robotic chains support the end effector (or simply the end platform).One of the best examples of this type of robot is flight simulators, which military and commercial pilots use to enhance their flight abilities by simulating real-life situations.The word parallel should not be misunderstood as it does not imply a geometric setting but rather a unique characteristic of the robot type in computer science. Here, parallel means that the endpoint of each individual linkage is completely different from others.The parallel robot is specially designed to remain rigid and resist all unwanted disturbances and movements, which is contrary to serial manipulator robots.Even though each actuator works with a degree of freedom, its flexibility is eventually constrained by the other actuators. Its rigidity and stiffness separate parallel manipulators from serial chain robots.Applications: Aerospace, automotive manufacturing, medical surgery, and other uses that require precise and dynamic motion.5.Articulated robotsWhen people discuss industrial robots, they likely mean articulated robots. Unlike many other robot types mentioned earlier, articulated robots excel in versatility and are well-suited for industrial tasks.Their flexibility is attributed to having extra axes, usually ranging from four to six but sometimes extending up to 10. Generally, they have six degrees of freedom (6-DOF), corresponding to the six major axes of movement: three translational axes (X, Y, Z) and three rotational axes (pitch, yaw, roll).Applications: Automotive manufacturing, electronics, aerospace, and general manufacturing. They are widely used in tasks ranging from welding car bodies to assembling electronic components.6.Spherical robotsImage Courtesy: Seelio.comA spherical robot is a mid-sized robot housed within a spherical ball, propelled by an Internal Driving Unit (IDU). In terms of sophistication, spherical robots fall between Cartesian or cylindrical robots and highly advanced articulated robots.They are often used in areas where omnidirectional movement is crucial, such as in tight spaces, crowded environments, or areas that require high agility.Applications: These mobile spherical robots prove highly effective for surveillance and monitoring tasks and can even operate underwater.Wheeled and Legged Robots7. Single Wheel Robots#Robot balancing on a single spherical wheelby @CMU_Robotics#AI #MachineLearning #ArtificialIntelligence #ML #Robotics #Tech #TechnologyCc: @simplivllc @ronald_vanloon @msftresearch pic.twitter.com/EqDNDu6z6b Ronald van Loon (@Ronald_vanLoon) April 1, 2021 Most of us have ridden a bicycle or motorcycle, but how many have tried a unicycle? I attempted it once and struggled just to sit properly. The challenge with unicycles is their lack of stability compared to bicycles, making balancing tough without proper support.Creating a single-wheeled robot is a tricky task for engineers as it requires dynamic stability and efficiency. An example of such a robot is MURATA GIRL.Murata Girl, or Murata Seiko-chan, is a unicycle robot manufactured by the Japanese electronics company Murata. According to the company, she has advanced gyro sensors that allow her to maintain balance, a Bluetooth device for communication, and an ultrasonic sensor for target detection.Applications: They serve as platforms for learning about control systems, robotics programming, and physics principles.8. Two-Wheel RobotsImage Courtesy: David P. AndersonAs the name suggests, two-wheel robots, are a type of mobile robot that features two wheels for movement and balance. They use a differential drive system (or similar mechanisms) where the speed and direction of each wheel can be controlled independently.This allows the robot to achieve various maneuvers, such as forward and backward motion, rotation in place, and curved paths.But like any other robot, they also have their own flaws. Two-wheeled robots have poor balance, and they always have to be in motion to maintain an upright position. To enhance stability, batteries are typically positioned directly beneath their bodies.Applications: Educational settings to teach robotics principles and control systems, and as a platform for testing control algorithms and navigation strategies.9. Three Wheel RobotsThree-wheel robots can be categorized into two types based on the steering mechanism of the wheels. In the first type, two wheels are independently powered, and the third wheel rotates freely for balance (differentially steered). In the second type, two wheels are powered by one source, while the third wheel is powered by another source.In differentially steered three-wheel robots, adjusting the relative rate of rotation of the two powered wheels changes the robots direction. If the two wheels rotate at the same rate and in the same direction, the robot continues moving straight.Applications: Educational settings to teach basic robotics concepts and programming. As unmanned ground vehicles for applications like surveillance, exploration, or indoor navigation.10. Humanoid RobotsTOPIO, a humanoid robot, played T.T at IREX, TokyoAs the name suggests, a humanoid robot is a type of robot that resemble and mimic the physical characteristics and behaviors of humans.Their design makes them fairly distinct from the other types of mobile robots. A typical humanoid robot consists of a head, two arms, a torso, and two legs, just like a human.One of the main components of a humanoid robot is sensors, which play a pivotal role in robotic paradigms. There are two types of sensors: Proprioceptive and Exteroceptive sensors. The former is responsible for the robots orientation, position, and other motor skills, while the latter includes visionary and sound sensors.Applications: Humanoid robots can perform specific jobs, such as inspection and disaster response at power plants, routine tasks for astronauts in space travel, and personal assistance and caregiving.11.Tripedal and Quadrupedal robotsBoston Dynamics WildCatWhile tripedal or three-legged robots are not so common, a robotics and mechanism laboratory in Virginia has developed a radical three-legged robot named STriDER. It uses a fairly new concept of passive dynamic locomotion to walk in all directions. This highly efficient robot can also be guided with minimal control.In contrast to tripedal robots, four-legged robots are more popular. The four-legged robots, also known as quadrupedal robots, have more stability, especially when they are not in motion. Many quadrupedal robots use the alternating technique (in pairs) to walk.Some of the best examples of quadrupedal robots are WildCat, Cheetah, and Big Dog.Applications: Exploringunknown or hazardous environments, navigating disaster-stricken regions to locate and assist survivors, and providing reconnaissance or carrying out tasks in military applications.12.Hexapod RobotsIn geometry, a Hexagon implies a six-sided polygon, so a hexapod would mean a robot with six legs, right? Yes, that is the case here. Although a robot can be perfectly stable on just three legs, the extra legs of a hexapod robot provide a great deal of flexibility and increase its capabilities.Many, if not all, hexapod designs draw inspiration from the locomotion of Hexapoda, the family of insects with six legs. They are used to test various biological theories about insect locomotion and motor control. These hexapods utilize various types of gaits to make a move. The most common are:Alternating tripod: Out of possible six, only three legs stay on the ground at a timeCrawl: only one leg stays on the ground at a time, giving the impression of crawlingSelf-Balancing hexapod robot. Android-based DIY Spider Robot.@makeyourpet is using the phones gravity sensor to keep the body level.Video source: @makeyourpetpic.twitter.com/8OOxf1EDmN Tech Burrito (@TechBurritoUno) November 16, 2022 Applications: Traversing environments with obstacles where traditional wheeled or tracked robots may face challenges, navigating complex and confined spaces, and conducting surveillance in regions where stability and adaptability are essential.13. Hybrid RobotHandle, one of Boston Dynamics fleet of humanoid and fairly frightening robots, is mature enough for a day jobvia @mashablepic.twitter.com/UrRpEoplno Universal Curiosity (@UniverCurious) May 31, 2021 Boston Dynamics, a robotics company, introduced a research robot called Handle, breaking away from traditional legged and wheeled designs. This innovative robot stands at an impressive height of up to 6.5 feet and can travel short distances at a speed of 9 mph. It can also jump vertically up to 4 feet.While Handle incorporates fundamental working principles seen in quadruped robots, such as balance and mobile manipulation, it stands out by utilizing only ten actuated joints. This simplicity sets it apart from other walking robots.By combining wheels (efficient on flat surfaces) and legs (effective for rough terrain), Handle demonstrates versatility and can adeptly navigate various environments.Applications: Material handling in warehouses and logistics settings; perfect for tasks such as palletizing and transporting goods.14.Flying RobotsWalmart is expanding its drone delivery service to cover nearly all of Dallas-Fort Worth 10 mile range 30-minute delivery 1.8 million households 75% of area populationIt immediately gives Walmart the largest drone delivery footprint of any US retailer pic.twitter.com/DuS8QkGKoW Morning Brew (@MorningBrew) January 10, 2024 Without a shadow of a doubt, flying robots have become the most popular type of robots. Major multinational companies are currently considering integrating these automated flying machines into their daily operations. These robots are not only impressive but also robust and aerodynamically efficient.They use different propulsion systems like rotors or propellers to generate lift and control their movement in the air. Some mimic the design of traditional airplanes with fixed wings they achieve lift through the shape of their wings and are typically more efficient for covering longer distances.Applications: Aerial photography/videography, surveying, mapping, search and rescue, and package delivery.In some regions, Amazon has started shipping products through flying drones. These fully electric and autonomous drones can fly up to 15 miles and deliver packages weighing 5 pounds in less than 30 minutes.Read: 14 Unique Early Experimental Flying Planes15. Swimming RobotsAnd why should flying robots get all the limelight; why not swimming robots? Yes, they are as cool as flying robots; the only difference is that instead of flying, they can swim. These robots can take the form of insects, fish, or big slithering snakes.Underwater robots often utilize ballast systems, which allow them to control their buoyancy, enabling vertical movement in the water column. Some can finely adjust their buoyancy to move between the surface and deeper water.One such unique robot is NASAs SWIM (short for Sensing With Independent Micro-Swimmers). Its a smartphone-sized robot capable of swimming through oceans and descending through the icy shell of a distant moon in search of extraterrestrial life. It can cover larger water regions compared to a singular probe.Applications: Ocean exploration, inspection of underwater structures like pipelines and dams, and study of marine ecosystems, water quality, and pollution.More To KnowWhat are the most common uses of humanoid robots?In addition to personal assistance and caregiving, human-like robots are used as research tools in various scientific fields, including biomechanics and cognitive science. They are used to develop complex prosthetics for people with disabilities and personalized healthcare aids for the elderly.In the entertainment industry, humanoid robots have served as stunt doubles. Some robots have been specifically built to simulate real-world, dynamic movement.At present, these robots can perform certain tasks only and are far from autonomous. Many practical applications are still unexplored.In the future, such robots (integrated with AI technology) could be useful for space exploration missions we dont have to bring them back to Earth once the mission is accomplished.Who developed the first autonomous robots?In 1948, British neurophysiologist William Grey Walter developed the first electronic autonomous robot with complex behavior. He named it Elmer.Due to its structure and slow rate of movement, it was often called a three-wheeled tortoise robot. It was capable of finding its own path to a charging station when it ran low on battery power.What are some of the most famous robots?Spot: An agile, mobile robot that can navigate the terrain with exceptional mobility.Sophia: A humanoid robot that follows faces, makes eye contact, and recognizes individuals.AIBO: A robotic dog that can recognize faces, respond to voice commands, and learn tricks via cloud computing.Stretch: A commercial warehouse robot that can handle a variety of package types, sizes, and stacking configurations.Robotics market sizeAccording to a report published in Precedence Research, the global robotics technology market size will exceed $283.6 billion by 2032, growing at a CAGR of 12.3% from 2023 to 2030.The major factor behind this growth includes the increasing demand for industrial robots that assist in material handling, manufacturing, welding, packaging and labeling, and security and inspection. Plus, the growing number of funding and investments in the field of robotics and machine learning is also driving this market across the globe.Read More17 Different Car Engine Types | Explained13 Best Robotic Companies In the World12 Advanced Robotic Animals That Are Transforming Scientific Research Automatons better known by most as robots have been a part of the collective human unconscious for a long time. The ancient Hebrews and Greeks both made references to golems and mechanical assistants to aid humans in their pursuits. The word robot didnt appear in literature until Karel Capeks 1921 play Rossums Universal Robots. In 1926, the film Metropolis became the first moving picture to portray a human-looking robot on the silver screen. Today, robots are a part of our daily lives. Even if we dont cross paths, robots are now working in our warehouses and assembly plants, exploring distant planets, and helping us inspect our infrastructure sites and even build brand-new ones. How do robots actually work, though? What are the key components to every robot, and how do they contribute to its overall functionality? Here are the eight main components of robots: One of the main components of a robot is found in any computer-driven technology: the central processing unit (CPU). The CPU acts as the brain of the robot. In other words, a CPU is the robot component that provides feedback to outside stimuli. All organisms function and survive by using feedback. Its what causes us to whip our hands away after weve touched a hot stove. The CPU in a robot takes in environmental data using sensors and then calls on its programming to perform the appropriate action. One of the earliest examples of using feedback to control a machine dates back to 1745 when Edmund Lee invented the automatic fantail. This device consisted of smaller vanes attached to the axle of a larger windmill that changed direction depending on the wind. This simple system may be a far cry from todays CPUs, but the core idea, functioning according to outside feedback, remains the same. In the anatomy of robots, CPUs function similarly to the human brain. Data comes in through sensors just as information comes to the neurons in your brain through your bodys senses, then the CPU interprets and acts accordingly. That takes us to the next key component of every robot: sensors. Sensors are the powerhouse of a robots feedback mechanism. They act as eyes and ears to help it take in information about its surroundings. Robots typically incorporate a wide range of sensor types to help them perform their work. These include: Light sensors Sound sensors Temperature sensors Contact sensors Proximity sensors Distance sensors Pressure sensors Positioning sensors Contact and proximity sensors help robots navigate more confidently and safely, especially when deployed alongside human workers. Pressure sensors may control the grip strength of a powered robotic arm so it doesnt crush the merchandise its processing. Positioning sensors include GPS, digital magnetic compasses and other tools to approximate the location of a robot, either indoors or outdoors. Some robots also navigate their surroundings through vision sensors, which function like eyes. Cameras feed in visual information, and then an artificial intelligence (AI) process called machine vision analyzes the video footage to recognize objects, guiding the robot. A newer but increasingly popular kind of robotic sensor is proprioceptive sensors. These components monitor a robots internal factors like heat, electric current and battery life. Since robots are often expensive, companies must stay on top of their maintenance, and this information helps them do that. If sensors are the eyes and ears of the robot, its actuators function like muscles. Actuators are small motors attached directly to the structure of the machine that facilitate movement. Some of the most common types include: Hydraulic: Uses oil to facilitate movement Pneumatic: Uses air to facilitate movement Electric: Uses electric current and magnets to facilitate movement Hydraulic actuators typically appear in heavy machinery, including mining and construction equipment, since they produce a lot of force and are relatively easy to maintain. Pneumatic actuators have many of the same benefits and are often less expensive, but theyre sensitive to vibrations. Theyre a popular choice for manufacturing and other stable, indoor settings. Electric actuators are by far the most common type today. They provide more control, have fewer environmental hazards, make little to no noise and are easy to program. Some of the simplest robots consist of little more than an arm, an actuator and a tool for performing work. More complex robots may use actuators to kick treads, wheels or even legs into motion. Step motors may be used when robots are deployed to complete delicate tasks that require finesses and accuracy. These are distinct motor designs that provide movement in specific intervals in a highly repeatable fashion. The ability to realize consistently high-quality results through robots and step motors is one of the reasons why robotic assembly took off in such a huge way in the 1960s and never slowed down. Robots also need a way to translate CPU signals and sensor data into actual movement in the actuator. Thats the job of controllers. These components are essentially additional processors that serve a more specific purpose than the robots main CPU. If the CPU is a robots brain, then its controllers are like its nerve system. When the CPU issues a command, like to move a certain way, that signal travels to the nerves the controller regulating a certain device where the action occurs. The controller doesnt dictate the movement, but it carries it out. Another quality that most robots have in common is end-effectors. The terms effector and end-effector are sometimes used interchangeably. Both terms refer to the tools aboard the robot the parts that perform the actual work and interact with the environment or a workpiece. Here are a few examples: Factory robots may feature end-effectors such as welding torches, screwdrivers, rivet guns and paint sprayers. Mobile robots usually have manipulators and grippers for lifting objects or disposing of dangerous ordinances. Robots like those dispatched to other planets may carry shovels, drills, hammers, cameras, lights and other analytical implements. From simple to complex, effectors allow robots to carry out their specific tasks with precision. For example, some of the latest robotic technology uses tiny scalpels, hands and cameras to perform surgery. These precise tools combined with robots stability and range of motion make surgery safer and less invasive. Some robots can perform operations with just a 25 mm incision, which would be far too small for a human to operate in. Just like human beings consume food when they need energy, robots need energy to function as well. Almost all robots receive their power from electricity. Power supplies can still take many different forms, however. Stationary robots, like those in factories, receive direct power just like any other appliance. Mobile robots typically sport high-capacity batteries, while robotic probes and satellites are generally equipped with solar panels for harvesting energy from the sun. As energy conservation has become a more pressing issue, many robots today include power-saving features. Some automatically switch to a low-power mode according to their usage, others use unique designs to minimize mechanical motion and still more use green energy sources. As this trend continues, additional novel ways to reduce robots power consumption will emerge. A robots programming isnt a physical component, but its still an essential part of the whole. Each of the basic components of robots weve looked at takes in stimuli or provides a form of feedback. The program within a robot provides the logic that drives these behaviors. You may be familiar with automation recipes, including If This Then That functionality. Its a concept anyone can explore with their smartphones and smart homes. Robots, likewise, contain logic trees that gather and analyze task and environmental data, and then choose an appropriate response based on that stimulus. For example, if a robot approaches a steep drop-off, it will back away automatically. A robotic probe exploring another world may activate a different tool depending on what its cameras and sensors detect around it. Other robotic programming examples are more advanced. The latest automated technology uses machine learning, which mimics how humans learn. These robots continually take note of different situations and outcomes they encounter and learn from them. The longer they operate, the more they understand, becoming increasingly accurate and helpful. Self-driving cars are an example of robotic systems that use machine learning. As companies test these vehicles on the road, they encounter more obstacles under more conditions, learning to identify them better. Without machine learning, these cars may not recognize every object they come across, which could be dangerous. Human decision-making happens quickly enough that were usually not aware of doing so in the moment. The same general concept applies to getting robots to perform specific tasks in uncertain circumstances without much or any human interaction. Many robots also feature a human-machine interface (HMI). Thats a technical term for a way for humans to interact with and control the robot. While the intersection of AI and robotics allows robots to do many things autonomously, most still have some kind of manual control mechanism. That may be a touchscreen where you can program the bot, a connected app or, in the case of some industrial robots, physical buttons and switches to adjust or shut off the machine. At their core, robots are supposed to remove humans from the work they perform. However, its usually a good idea to provide a way to take control of the bot if necessary. If nothing else, some robots need an emergency shut-off switch, which is still a kind of simple HMI. Robots have long been a bellwether for the march of technological progress. Early attempts at these machines look halting and clumsy now when you consider the agility of something like Boston Dynamics robotic dog, Spot. Far from a toy, this $74,500 robot is capable of almost limitless applications, according to Boston Dynamics spokespeople, ranging from pulling heavy loads to conducting automated surveillance of private property. The march continues. Over the coming years, well soon see robots taking on an even wider variety of forms and carrying out many more tasks than they do today. From performing jobs for small businesses to building and maintaining some of the most impressive structures in the world, if theres something to inspect, fabricate or carry, theres probably a robot for that. Want to dive deeper into robotics? Read What Are the Most Common Types of Robots? Originally Publish Date 12/7/2020 Updated 12/23/2024 Post Views: 36,073 Machine capable of carrying out a complex series of actions automaticallyFor other uses, see Robot (disambiguation).ASIMO (2000) at the Expo 2005Articulated welding robots used in a factory are a type of industrial robot.The quadrupedal military robot Cheetah, an evolution of BigDog (pictured), was clocked as the world's fastest legged robot in 2012, beating the record set by an MIT bipedal robot in 1989.[1]Part of a series onAutomationAutomation in generalBankingBuildingHomeHighway systemLaboratoryLibraryBroadcastMixPool cleanerPop musicReasoningSemi-automationTelephoneAttendantSwitchboardTeller machineVehicularVending machineRobotics and robotsDomesticVacuum cleanerRoombaLawn mowerGuided vehicleIndustrialPaintODDImpact of automationManumationOOLBiasSelf-driving carsTechnological unemploymentJobless recoveryPost-work societyThreatTrade shows and awardsASP-DACDACDATEIEEE Robotics and Automation AwardICCADvteA robot is a machineespecially one programmable by a computercapable of carrying out a complex series of actions automatically.[2] A robot can be guided by an external control device, or the control may be embedded within. Robots may be constructed to evoke human form, but most robots are task-performing machines, designed with an emphasis on stark functionality, rather than expressive aesthetics.Robots can be autonomous or semi-autonomous and range from humanoids such as Honda's Advanced Step in Innovative Mobility (ASIMO) and TOSY's TOSY Ping Pong Playing Robot (TOPIO) to industrial robots, medical operating robots, patient assist robots, dog therapy robots, collectively programmed swarm robots, UAV drones such as General Atomics MQ-1 Predator, and even microscopic nanorobots. By mimicking a lifelike appearance or automating movements, a robot may convey a sense of intelligence or thought of its own. Autonomous things are expected to proliferate in the future, with home robotics and the autonomous car as some of the main drivers.[3]The branch of technology that deals with the design, construction, operation, and application of robots,[4] as well as computer systems for their control, sensory feedback, and information processing is robotics. These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behavior, or cognition. Many of today's robots are inspired by nature contributing to the field of bio-inspired robotics. These robots have also created a newer branch of robotics: soft robotics.From the time of ancient civilization, there have been many accounts of user-configurable automated devices and even automata, resembling humans and other animals, such as animatronics, designed primarily as entertainment. As mechanical techniques developed through the Industrial age, there appeared more practical applications such as automated machines, remote-control and wireless remote-control.The term comes from a Slavic root, robot-, with meanings associated with labor. The word "robot" was first used to denote a fictional humanoid in a 1920 Czech-language play R.U.R. (Rossumovi Univerzln Roboti Rossum's Universal Robots) by Karel apek, though it was Karel's brother Josef apek who was the word's true inventor.[5][6][7] Electronics evolved into the driving force of development with the advent of the first electronic autonomous robots created by William Grey Walter in Bristol, England in 1948, as well as Computer Numerical Control (CNC) machine tools in the late 1940s by John T. Parsons and Frank L. Stulen.The first commercial, digital and programmable robot was built by George Devol in 1954 and was named the Unimate. It was sold to General Motors in 1961 where it was used to lift pieces of hot metal from die casting machines at the Inland Fisher Guide Plant in the West Trenton section of Ewing Township, New Jersey.[8]Robots have replaced humans[9] in performing repetitive and dangerous tasks which humans prefer not to do, or are unable to do because of size limitations, or which take place in extreme environments such as outer space or the bottom of the sea. There are concerns about the increasing use of robots and their role in society. Robots are blamed for rising technological unemployment as they replace workers in increasing numbers of functions.[10] The use of robots in military combat raises ethical concerns. The possibilities of robot autonomy and potential repercussions have been addressed in fiction and may be a realistic concern in the future.iCub is physically anthropomorphic; it looks like a human.There is no consensus on which machines qualify as robots but there is general agreement among experts, and the public, that robots tend to possess some or all of the following abilities and functions: accept electronic programming, process data or physical perceptions electronically, operate autonomously to some degree, move around, operate physical parts of itself or physical processes, sense and manipulate their environment, and exhibit intelligent behavior, especially behavior which mimics humans or other animals.[11][12]The word robot can refer to both physical robots and virtual software agents, but the latter are usually referred to as bots.[13] Related to the concept of a robot is the field of synthetic biology, which studies entities whose nature is more comparable to living things than to machines.Simpler automated machines are called automatons, like animatronics, often made to resemble humans or animals. Humanoid robots that resemble humans esthetically, possibly even organically, are called androids, while android can be shortened to droid, referring to robots with a broader likeness. On the other hand, a human that is augmented with artificial machines is called a cyborg, which is a particular type of transhuman.Main article: History of robotsMany ancient mythologies, and most modern religions include artificial people, such as the mechanical servants built by the Greek god Hephaestus[14] (Vulcan to the Romans), the clay golems of Jewish legend and clay giants of Norse legend, and Galatea, the mythical statue of Pygmalion that came to life. Since circa 400 BC, myths of Crete include Talos, a man of bronze who guarded the island from pirates.A hypothetical reconstuction of Philo's automatic robot servant (3rd c. B.C.) in Kotsanas Museum of Ancient Greek Technology, Athens, Greece.In the 4th century BC, the Greek mathematician Archytas of Tarentum postulated a mechanical steam-operated bird he called "The Pigeon".[15] The Greek engineer Ctesibius (c. 270 BC) "applied a knowledge of pneumatics and hydraulics to produce the first organ and water clocks with moving figures."[16]:2[17] Philo of Byzantium described a washstand automaton. Hero of Alexandria (1070 AD), a Greek mathematician and inventor, created numerous user-configurable automated devices, and described machines powered by air pressure, steam and water, including a "speaking" automaton.[18]In ancient China, the 3rd-century text of the Lie Zi describes an account of humanoid automata, involving a much earlier encounter between Chinese emperor King Mu of Zhou and a mechanical engineer known as Yan Shi, an 'artificer'.[19] Yan Shi proudly presented the king with a life-size, human-shaped figure of his mechanical 'handiwork' made of leather, wood, and artificial organs.[19] There are also accounts of flying automata in the Han Fei Zi and other texts, which attributes the 5th century BC Mohist philosopher Mozi and his contemporary Lu Ban with the invention of artificial wooden birds (ma yuan) that could successfully fly.[20]Su Song's astronomical clock tower showing the mechanical figurines which chimed the hoursIn 1066, the Chinese inventor Su Song built a water clock in the form of a tower which featured mechanical figurines which chimed the hours.[21][22][23] His mechanism had a programmable drum machine with pegs (cams) that bumped into little levers that operated percussion instruments. The drummer could be made to play different rhythms and different drum patterns by moving the pegs to different locations.[23]Samarangana Sutradhara, a Sanskrit treatise by Bhoja (11th century), includes a chapter about the construction of mechanical contrivances (automata), including mechanical bees and birds, fountains shaped like humans and animals, and male and female dolls that refilled oil lamps, danced, played instruments, and re-enacted scenes from Hindu mythology.[24][25][26] The 11th century Lokapannatti tells of how the Buddha's relics were protected by mechanical robots (bhuta vahana yanta), from the kingdom of Roma visaya (Rome); until they were disarmed by King Ashoka.[27]Al-Jazari a musical toy13th century Muslim scientist Ismail al-Jazari created several automated devices. He built automated moving peacocks driven by hydropower.[28] He also invented the earliest known automatic gates, which were driven by hydropower,[29] created automatic doors as part of one of his elaborate water clocks.[30] One of al-Jazari's humanoid automata was a waitress that could serve water, tea or drinks. The drink was stored in a tank with a reservoir from where the drink drips into a bucket and, after seven minutes, into a cup, after which the waitress appears out of an automatic door serving the drink.[31] Al-Jazari invented a hand washing automaton incorporating a flush mechanism now used in modern flush toilets. It features a female humanoid automaton standing by a basin filled with water. When the user pulls the lever, the water drains and the female automaton refills the basin.[16]Mark E. Rosheim summarizes the advances in robotics made by Muslim engineers, especially al-Jazari, as follows:Unlike the Greek designs, these Arab examples reveal an interest, not only in dramatic illusion, but in manipulating the environment for human comfort. Thus, the greatest contribution the Arabs made, besides preserving, disseminating and building on the work of the Greeks, was the concept of practical application. This was the key element that was missing in Greek robotic science.[16]:9Model of Leonardo's robot with inner workings. Possibly constructed by Leonardo da Vinci around 1495.[32] In the 14th century, the coronation of Richard II of England featured an automata angel.[33]In Renaissance Italy, Leonardo da Vinci (14521519) sketched plans for a humanoid robot around 1495. Da Vinci's notebooks, rediscovered in the 1950s, contained detailed drawings of a mechanical knight now known as Leonardo's robot, able to sit up, wave its arms and move its head and jaw.[34] The design was probably based on anatomical research recorded in his Vitruvian Man. It is not known whether he attempted to build it. According to Encyclopdia Britannica, Leonardo da Vinci may have been influenced by the classic automata of al-Jazari.[28]In Japan, complex animal and human automata were built between the 17th to 19th centuries, with many described in the 18th century Karakuri zui (Illustrated Machinery, 1796). One such automaton was the karakuri ningy, a mechanized puppet.[35] Different variations of the karakuri existed: the Butai karakuri, which were used in theatre, the Zashiki karakuri, which were small and used in homes, and the Dashi karakuri which were used in religious festivals, where the puppets were used to perform reenactments of traditional myths and legends.In France, between 1738 and 1739, Jacques de Vaucanson exhibited several life-sized automatons: a flute player, a pipe player and a duck. The mechanical duck could flap its wings, crane its neck, and swallow food from the exhibitor's hand, and it gave the illusion of digesting its food by excreting matter stored in a hidden compartment.[36] About 30 years later in Switzerland the clockmaker Pierre Jaquet-Droz made several complex mechanical figures that could write and play music. Several of these devices still exist and work.[37]The Brennan torpedo, one of the earliest 'guided missiles'Remotely operated vehicles were demonstrated in the late 19th century in the form of several types of remotely controlled torpedoes. The early 1870s saw remotely controlled torpedoes by John Ericsson (pneumatic), John Louis Lay (electric wire guided), and Victor von Scheliha (electric wire guided).[38]The Brennan torpedo, invented by Louis Brennan in 1877, was powered by two contra-rotating propellers that were spun by rapidly pulling out wires from drums wound inside the torpedo. Differential speed on the wires connected to the shore station allowed the torpedo to be guided to its target, making it "the world's first practical guided missile".[39] In 1897 the British inventor Ernest Wilson was granted a patent for a torpedo remotely controlled by "Hertzian" (radio) waves[40][41] and in 1898 Nikola Tesla publicly demonstrated a wireless-controlled torpedo that he hoped to sell to the US Navy.[42][43]In 1903, the Spanish engineer Leonardo Torres Quevedo demonstrated a radio control system called Telekino at the Paris Academy of Sciences,[44] which he wanted to use to control an airship of his own design. He obtained several patents for the system in other countries.[45][46] Unlike previous 'on/off' techniques, Torres established a method for controlling any mechanical or electrical device with different states of operation.[47] The Telekino remotely controlled a tricycle in 1904, considered the first case of an unmanned ground vehicle, and an electric boat with a crew in 1906, which was controlled at a distance over 2km.[48]Archibald Low, known as the "father of radio guidance systems" for his pioneering work on guided rockets and planes during the First World War. In 1917, he demonstrated a remote controlled aircraft to the Royal Flying Corps and in the same year built the first wire-guided rocket.W. H. Richards with "George", 1932In 1928, one of the first humanoid robots, Eric, was exhibited at the annual exhibition of the Model Engineers Society in London, where it delivered a speech. Invented by W. H. Richards, the robot's frame consisted of an aluminium body of armour with eleven electromagnets and one motor powered by a twelve-volt power source. The robot could move its hands and head and could be controlled through remote control or voice control.[49] Both Eric and his "brother" George toured the world.[50]Westinghouse Electric Corporation built Televox in 1926; it was a cardboard cutout connected to various devices which users could turn on and off. In 1939, the humanoid robot known as Elektro was debuted at the 1939 New York World's Fair.[51][52] Seven feet tall (2.1 m) and weighing 265 pounds (120.2kg), it could walk by voice command, speak about 700 words (using a 78-rpm record player), smoke cigarettes, blow up balloons, and move its head and arms. The body consisted of a steel gear, cam and motor skeleton covered by an aluminum skin. In 1928, Japan's first robot, Gakutensoku, was designed and constructed by biologist Makoto Nishimura.The German V-1 flying bomb was equipped with systems for automatic guidance and range control, flying on a predetermined course (which could include a 90-degree turn) and entering a terminal dive after a predetermined distance. It was reported as being a 'robot' in contemporary descriptions.[53]The first electronic autonomous robots with complex behaviour were created by William Grey Walter of the Burden Neurological Institute at Bristol, England in 1948 and 1949. He wanted to prove that rich connections between a small number of brain cells could give rise to very complex behaviors essentially that the secret of how the brain worked lay in how it was wired up. His first robots, named Elmer and Elsie, were constructed between 1948 and 1949 and were often described as tortoises due to their shape and slow rate of movement. The three-wheeled tortoise robots were capable of phototaxis, by which they could find their way to a recharging station when they ran low on battery power.Walter stressed the importance of using purely analogue electronics to simulate brain processes at a time when his contemporaries such as Alan Turing and John von Neumann were all turning towards a view of mental processes in terms of digital computation. His work inspired subsequent generations of robotics researchers such as Rodney Brooks, Hans Moravec and Mark Tilden. Modern incarnations of Walter's turtles may be found in the form of BEAM robotics.[54]The first digitally operated and programmable robot was invented by George Devol in 1954 and was ultimately called the Unimate. This ultimately laid the foundations of the modern robotics industry.[55] Devol sold the first Unimate to General Motors in 1960, and it was installed in 1961 in a plant in Trenton, New Jersey to lift hot pieces of metal from a die casting machine and stack them.[56]The first palletizing robot was introduced in 1963 by the Fuji Yusoki Kogyo Company.[57] In 1973, a robot with six electromechanically driven axes was patented[58][59][60] by KUKA robotics in Germany, and the programmable universal manipulation arm was invented by Victor Scheinman in 1976, and the design was sold to Unimation.Commercial and industrial robots are now in widespread use performing jobs more cheaply or with greater accuracy and reliability than humans. They are also employed for jobs which are too dirty, dangerous or dull to be suitable for humans. Robots are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, and mass production of consumer and industrial goods.[61]External videos Atlas, The Next GenerationFurther information: RoboticsVarious techniques have emerged to develop the science of robotics and robots. One method is evolutionary robotics, in which a number of differing robots are submitted to tests. Those which perform best are used as a model to create a subsequent "generation" of robots. Another method is developmental robotics, which tracks changes and development within a single robot in the areas of problem-solving and other functions. Another new type of robot is just recently introduced which acts both as a smartphone and robot and is named RoboHon.[62]As robots become more advanced, eventually there may be a standard computer operating system designed mainly for robots. Robot Operating System (ROS) is an open-source software set of programs being developed at Stanford University, the Massachusetts

Institute of Technology, and the Technical University of Munich, Germany, among others. ROS provides ways to program a robot's navigation and limbs regardless of the specific hardware involved. It also provides high-level commands for items like image recognition and even opening doors. When ROS boots up on a robot's computer, it would obtain data on attributes such as the length and movement of robots' limbs. It would relay this data to higher-level algorithms. Microsoft is also developing a "Windows for robots" system with its Robotics Developer Studio, which has been available since 2007.[63]Japan hopes to have full-scale commercialization of service robots by 2025. Much technological research in Japan is led by Japanese government agencies, particularly the Trade Ministry.[64]Many future applications of robotics seem obvious to people, even though they are well beyond the capabilities of robots available at the time of the prediction.[65][66] As early as 1982 people were confident that someday robots would:[67] 1. Clean parts by removing molding flash 2. Spray paint automobiles with absolutely no human presence 3. Pack things in boxesfor example, orient and nest chocolate candies in candy boxes 4. Make electrical cable harness 5. Load trucks with boxesa packing problem 6. Handle soft goods, such as garments and shoes 7. Shear sheep 8. Be used as prostheses 9. Cook fast food and work in other service industries 10. Work as a household robot.Generally such predictions are overly optimistic in timescale.This section needs to be updated. Please help update this article to reflect recent events or newly available information. (August 2021)In 2008, Caterpillar Inc. developed a dump truck which can drive itself without any human operator.[68] Many analysts believe that self-driving trucks may eventually revolutionize logistics.[69] By 2014, Caterpillar had a self-driving dump truck which is expected to greatly change the process of mining. In 2015, these Caterpillar trucks were actively used in mining operations in Australia by the mining company Rio Tinto Coal Australia.[70][71][72][73] Some analysts believe that within the next few decades, most trucks will be self-driving.[74]A literate or 'reading robot' named Marge has intelligence that comes from software. She can read newspapers, find and correct misspelled words, learn about banks like Barclays, and understand that some restaurants are better places to eat than others.[75]Baxter is a new robot introduced in 2012 which learns by guidance. A worker could teach Baxter how to perform a task by moving its hands in the desired motion and having Baxter memorize them. Extra dials, buttons, and controls are available on Baxter's arm for more precision and features. Any regular worker could program Baxter and it only takes a matter of minutes, unlike usual industrial robots that take extensive programs and coding to be used. This means Baxter needs no programming to operate. No software engineers are needed. This also means Baxter can be taught to perform multiple, more complicated tasks. Sawyer was added in 2015 for smaller, more precise tasks.[76]Prototype cooking robots have been developed and could be programmed for autonomous, dynamic and adjustable preparation of discrete meals.[77][78]See also: Glossary of roboticsA scene from Karel apek's 1920 play R.U.R. (Rossum's Universal Robots), showing three robotsThe word robot was introduced to the public by the Czech interwar writer Karel apek in his play R.U.R. (Rossum's Universal Robots), published in 1920.[6] The play begins in a factory that uses a chemical substitute for protoplasm to manufacture living, simplified people called robots. The play does not focus in detail on the technology behind the creation of these living creatures, but in their appearance they prefigure modern ideas of androids, creatures who can be mistaken for humans. These mass-produced workers are depicted as efficient but emotionless, incapable of original thinking and indifferent to self-preservation. At issue is whether the robots are being exploited and the consequences of human dependence upon commodified labor (especially after a number of specially-formulated robots achieve self-awareness and incite robots all around the world to rise up against the humans).Karel apek himself did not coin the word. He wrote a short letter in reference to an etymology in the Oxford English Dictionary in which he named his brother, the painter and writer Josef apek, as its actual originator.[6]In an article in the Czech journal Lidov noviny in 1933, he explained that he had originally wanted to call the creatures laboi ('workers', from Latin labor). However, he did not like the word, and sought advice from his brother Josef, who suggested roboti. The word robota means literally 'corve, serf labor', and figuratively 'drudgery, hard work' in Czech and also (more general) 'work, labor' in many Slavic languages (e.g.: Bulgarian, Russian, Serbian, Croatian, Slovenian, Slovak, Polish, Macedonian, Ukrainian and archaic Czech) as well as robot in Hungarian. Traditionally the robota (Hungarian robot) was the work period a serf (corve) had to give for his lord, typically six months of the year. The origin of the word is the Old Church Slavonic rabota 'servitude' ('work' in contemporary Bulgarian, Macedonian and Russian), which in turn comes from the Proto-Indo-European root *orbh-. Robot is cognate with the German Arbeit 'work'.[79][80]English pronunciation of the word has evolved relatively quickly since its introduction. In the U.S. during the late 1930s to early 1940s it was pronounced /robot/.[81][bettersourceneeded] By the late 1950s to early 1960s, some were pronouncing it /robt/, while others used /robt/[82] By the 1970s, its current pronunciation /robt/ had become predominant.The word robotics, used to describe this field of study,[4] was coined by the science fiction writer Isaac Asimov. Asimov created the Three Laws of Robotics which are a recurring theme in his books. These have since been used by many others to define laws used in fiction. (The three laws are pure fiction, and no technology yet created has the ability to understand or follow them, and in fact most robots serve military purposes, which run quite contrary to the first law and often the third law. "People think about Asimov's laws, but they were set up to point out how a simple ethical system doesn't work. If you read the short stories, every single one is about a failure, and they are totally impractical," said Dr. Joanna Bryson of the University of Bath.[83])A laparoscopic robotic surgery machineMain articles: Mobile robot and Automated guided vehicleMobile robots[84] have the capability to move around in their environment and are not fixed to one physical location. An example of a mobile robot that is in common use today is the automated guided vehicle or automatic guided vehicle (AGV). An AGV is a mobile robot that follows markers or wires in the floor, or uses vision or lasers.[85] AGVs are discussed later in this article.Mobile robots are also found in industry, military and security environments.[86] They also appear as consumer products, for entertainment or to perform certain tasks like vacuum cleaning. Mobile robots are the focus of a great deal of current research and almost every major university has one or more labs that focus on mobile robot research.[87]Mobile robots are usually used in tightly controlled environments such as on assembly lines because they have difficulty responding to unexpected interference. Because of this most humans rarely encounter robots. However domestic robots for cleaning and maintenance are increasingly common in and around homes in developed countries. Robots can also be found in military applications.[88]Main articles: Industrial robot and Manipulator (device)A pick and place robot in a factoryIndustrial robots usually consist of a jointed arm (multi-linked manipulator) and an end effector that is attached to a fixed surface. One of the most common type of end effector is a gripper assembly.The International Organization for Standardization gives a definition of a manipulating industrial robot in ISO 8373:"an automatically controlled, reprogrammable, multipurpose, manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications."[89]This definition is used by the International Federation of Robotics, the European Robotics Research Network (EURON) and many national standards committees.[90]The industrial robots in food and drink processing plants are used for tasks such as feeding machines, packaging, and palletizing, which have replaced many manual, physical tasks. The complexity of digital skills required by workers varies depending on the level of automation and the specific tasks involved.[91] Main article: Service robotMost commonly industrial robots are fixed robotic arms and manipulators used primarily for production and distribution of goods. The term "service robot" is less well-defined. The International Federation of Robotics has proposed a tentative definition, "A service robot is a robot which operates semi- or fully autonomously to perform services useful to the well-being of humans and equipment, excluding manufacturing operations."[92]Main article: Educational roboticsRobots are used as educational assistants to teachers. From the 1980s, robots such as turtles were used in schools and programmed using the Logo language.[93][94]There are robot kits like Lego Mindstorms, BIOLOID, OLLO from ROBOTIS, or BotBrain Educational Robots can help children to learn about mathematics, physics, programming, and electronics. Robotics have also been introduced into the lives of elementary and high school students in the form of robot competitions with the company FIRST (For Inspiration and Recognition of Science and Technology). The organization is the foundation for the FIRST Robotics Competition, FIRST Tech Challenge, FIRST Lego League Challenge and FIRST Lego League Explore competitions.There have also been robots such as the teaching computer, Leachim (1974).[95] Leachim was an early example of speech synthesis using the Diphone synthesis method. 2-XL (1976) was a robot shaped game / teaching toy based on branching between audible tracks on an 8-track tape player, both invented by Michael J. Freeman.[96] Later, the 8-track was upgraded to tape cassettes and then to digital.Main article: Self-reconfiguring modular robotModular robots are a new breed of robots that are designed to increase the use of robots by modularizing their architecture.[97] The functionality and effectiveness of a modular robot is easier to increase compared to conventional robots. These robots are composed of a single type of identical, several different identical module types, or similarly shaped modules, which vary in size. Their architectural structure allows hyper-redundancy for modular robots, as they can be designed with more than 8 degrees of freedom (DOF). Creating the programming, inverse kinematics and dynamics for modular robots is more complex than with traditional robots. Modular robots may be composed of L-shaped modules, cubic modules, and U and H-shaped modules. ANAT technology, an early modular robotic technology patented by Robotics Design Inc., allows the creation of modular robots from U- and H-shaped modules that connect in a chain, and are used to form heterogeneous and homogenous modular robot systems. These "ANAT robots" can be designed with "n" DOF as each module is a complete motorized robotic system that folds relatively to the modules connected before and after it in its chain, and therefore a single module allows one degree of freedom. The more modules that are connected to one another, the more degrees of freedom it will have. L-shaped modules can also be designed in a chain, and must become increasingly smaller as the size of the chain increases, as payloads attached to the end of the chain place a greater strain on modules that are further from the base. ANAT H-shaped modules do not suffer from this problem, as their design allows a modular robot to distribute pressure and impacts evenly amongst other attached modules, and therefore payload-carrying capacity does not decrease as the length of the arm increases. Modular robots can be manually or self-reconfigured to form a different robot, that may perform different applications. Because modular robots of the same architecture type are composed of modules that compose different modular robots, a snake-arm robot can combine with another to form a dual or quadra-arm robot, or can split into several mobile robots, and mobile robots can split into multiple smaller ones, or combine with others into a larger or different one. This allows a single modular robot the ability to be fully specialized in a single task, as well as the capacity to be specialized to perform multiple different tasks.Modular robotic technology is currently being applied in hybrid transportation,[98] industrial automation,[99] duct cleaning[100] and handling. Many research centres and universities have also studied this technology, and have developed prototypes.A collaborative robot or cobot is a robot that can safely and effectively interact with human workers while performing simple industrial tasks. However, end-effectors and other environmental conditions may create hazards, and as such risk assessments should be done before using any industrial motion-control application.[101]The collaborative robots most widely used in industries today are manufactured by Universal Robots in Denmark.[102]Rethink Roboticsfounded by Rodney Brooks, previously with iRobotintroduced Baxter in September 2012; as an industrial robot designed to safely interact with neighboring human workers, and be programmable for performing simple tasks.[103] Baxters stop if they detect a human in the way of their robotic arms and have prominent off switches. Intended for sale to small businesses, they are promoted as the robotic analogue of the personal computer.[104] As of May2014[update], 190 companies in the US have bought Baxters and they are being used commercially in the UK.[10]TOPIO, a humanoid robot, played ping pong at Tokyo International Robot Exhibition (IREX) 2009.[105][106]Roughly half of all the robots in the world are in Asia, 32% in Europe, and 16% in North America, 1% in Australasia and 1% in Africa.[107] 40% of all the robots in the world are in Japan,[108] making Japan the country with the highest number of robots.Main articles: Roboethics and Ethics of artificial intelligenceAn android, or robot designed to resemble a human, can appear comforting to some people and disturbing to others.[109]As robots have become more advanced and sophisticated, experts and academics have increasingly explored the questions of what ethics might govern robots' behavior,[110][111] and whether robots might be able to claim any kind of social, cultural, ethical or legal rights.[112] One scientific team has said that it was possible that a robot brain would exist by 2019.[113] Others predict robot intelligence breakthroughs by 2050.[114] Recent advances have made robotic behavior more sophisticated.[115] The social impact of intelligent robots is subject of a 2010 documentary film called Plug & Pray.[116]Vernor Vinge has suggested that a moment may come when computers and robots are smarter than humans. He calls this "the Singularity".[117] He suggests that it may be somewhat or possibly very dangerous for humans.[118] This is discussed by a philosophy called Singularitarianism.In 2009, experts attended a conference hosted by the Association for the Advancement of Artificial Intelligence (AAAI) to discuss whether computers and robots might be able to acquire any autonomy, and how much these abilities might pose a threat or hazard. They noted that some robots have acquired various forms of semi-autonomy, including being able to find power sources on their own and being able to independently choose targets to attack with weapons. They also noted that some computer viruses can evade elimination and have achieved "cockroach intelligence." They noted that self-awareness as depicted in science-fiction is probably unlikely, but that there were other potential hazards and pitfalls.[117] Various media sources and scientific groups have noted separate trends in differing areas which might together result in greater robotic functionalities and autonomy, and which pose some inherent concerns.[119][120][121]Some experts and academics have questioned the use of robots for military combat, especially when such robots are given some degree of autonomous functions.[122] There are also concerns about technology which might allow some armed robots to be controlled mainly by other robots.[123] The US Navy has funded a report which indicates that, as military robots become more complex, there should be greater attention to implications of their ability to make autonomous decisions.[124][125] One researcher states that autonomous robots might be more humane, as they could make decisions more effectively. However, other experts question this.[126]One robot in particular, the EATR, has generated public concerns[127] over its fuel source, as it can continually refuel itself using organic substances.[128] Although the engine for the EATR is designed to run on biomass and vegetation[129] specifically selected by its sensors, which it can find on battlefields or other local environments, the project has stated that chicken fat can also be used.[130]Manuel De Landa has noted that "smart missiles" and autonomous bombs equipped with artificial perception can be considered robots, as they make some of their decisions autonomously. He believes this represents an important and dangerous trend in which humans are handing over important decisions to machines.[131]Main article: Technological unemploymentFor centuries, people have predicted that machines would make workers obsolete and increase unemployment, although the causes of unemployment are usually thought to be due to social policy.[132][133][134]A recent example of human replacement involves Taiwanese technology company Foxconn who, in July 2011, announced a three-year plan to replace workers with more robots. At present the company uses ten thousand robots but will increase them to a million robots over a three-year period.[135]Lawyers have speculated that an increased prevalence of robots in the workplace could lead to the need to improve redundancy laws.[136]Kevin J. Delaney said "Robots are taking human jobs. But Bill Gates believes that governments should tax companies' use of them, as a way to at least temporarily slow the spread of automation and to fund other types of employment."[137] The robot tax would also help pay a guaranteed living wage to the displaced workers.The World Bank's World Development Report 2019 puts forth evidence showing that while automation displaces workers, technological innovation creates more new industries and jobs on balance.[138]A general-purpose robot acts as a guide during the day and a security guard at night.See also: List of robotsAt present, there are two main types of robots, based on their use: general-purpose autonomous robots and dedicated robots.Robots can be classified by their specificity of purpose. A robot might be designed to perform one particular task extremely well, or a range of tasks less well. All robots by their nature can be re-programmed to behave differently, but some are limited by their physical form. For example, a factory robot arm can perform jobs such as cutting, welding, gluing, or acting as a fairground ride, while a pick-and-place robot can only populate printed circuit boards.Main article: Autonomous robotGeneral-purpose autonomous robots can perform a variety of functions independently. General-purpose autonomous robots typically can navigate independently in known spaces, handle their own re-charging needs, interface with electronic doors and elevators and perform other basic tasks. Like computers, general-purpose robots can link with networks, software and accessories that increase their usefulness. They may recognize people or objects, talk, provide companionship, monitor environmental quality, respond to alarms, pick up supplies and perform other useful tasks. General-purpose robots may perform a variety of functions simultaneously or they may take on different roles at different times of day. Some such robots try to mimic human beings and may even resemble people in appearance; this type of robot is called a humanoid robot. Humanoid robots are still in a very limited stage, as no humanoid robot can, as of yet, actually navigate around a room that it has never been in.[139] Thus, humanoid robots are really quite limited, despite their intelligent behaviors in their well-known environments.Over the last three decades, automobile factories have become dominated by robots. A typical factory contains hundreds of industrial robots working on fully automated production lines, with one robot for every ten human workers. On an automated production line, a vehicle chassis on a conveyor is welded, glued, painted and finally assembled at a sequence of robot stations.Industrial robots are also used extensively for palletizing and packaging of manufactured goods, for example for rapidly taking drink cartons from the end of a conveyor belt and placing them into boxes, or for loading and unloading machining centers.Mass-produced printed circuit boards (PCBs) are almost exclusively manufactured by pick-and-place robots, typically with SCARA manipulators, which remove tiny electronic components from strips or trays, and place them on to PCBs with great accuracy.[140] Such robots can place hundreds of thousands of components per hour, far out-performing a human in speed, accuracy, and reliability.[141]An intelligent AGV drops-off goods without needing lines or beacons in the workspace.Mobile robots, following markers or wires in the floor, or using vision[85] or lasers, are used to transport goods around large facilities, such as warehouses, container ports, or hospitals.[142]Limited to tasks that could be accurately defined and had to be performed the same way every time. Very little feedback or intelligence was required, and the robots needed only the most basic exteroceptors (sensors). The limitations of these AGVs are that their paths are not easily altered and they cannot alter their paths if obstacles block them. If one AGV breaks down, it may stop the entire operation.Developed to deploy triangulation from beacons or bar code grids for scanning on the floor or ceiling. In most factories, triangulation systems tend to require moderate to high maintenance, such as daily cleaning of all beacons or bar codes. Also, if a tall pallet or large vehicle blocks beacons or a bar code is marred, AGVs may become lost. Often such AGVs are designed to be used in human-free environments.Such as SmartLoader,[143] SpeciMinder,[144] ADAM,[145] Tug[146] Eskorta,[147] and MT 400 with Motivity[148] are designed for people-friendly workspaces. They navigate by recognizing natural features. 3D scanners or other means of sensing the environment in two or three dimensions help to eliminate cumulative errors in dead-reckoning calculations of the AGV's current position. Some AGVs can create maps of their environment using scanning lasers with simultaneous localization and mapping (SLAM) and use those maps to navigate in real time with other path planning and obstacle avoidance algorithms. They are able to operate in complex environments and perform non-repetitive and non-sequential tasks such as transporting photomasks in a semiconductor lab, specimens in hospitals and goods in warehouses. For dynamic areas, such as warehouses full of pallets, AGVs require additional strategies using three-dimensional sensors such as time-of-flight or stereovision cameras.See also: Dirty, dangerous and demeaningThere are many jobs that humans would rather leave to robots. The job may be boring, such as domestic cleaning or sports field line marking, or dangerous, such as exploring inside a volcano.[149] Other jobs are physically inaccessible, such as exploring another planet,[150] cleaning the inside of a long pipe, or performing laparoscopic surgery.[151]Almost every unmanned space probe ever launched was a robot.[152][153] Some were launched in the 1960s with very limited abilities, but their ability to fly and land (in the case of Luna 9) is an indication of their status as a robot. This includes the Voyager probes and the Galileo probes, among others.A U.S. Marine Corps technician prepares to use a telerobot to detonate a buried improvised explosive device near Camp Fallujah, Iraq.Teleoperated robots, or telerobots, are devices remotely operated from a distance by a human operator rather than following a predetermined sequence of movements, but which has semi-autonomous behaviour. They are used when a human cannot be present on site to perform a job because it is dangerous, far away, or inaccessible. The robot may be in another room or another country, or may be on a very different scale to the operator. For instance, a laparoscopic surgery robot allows the surgeon to work inside a human patient on a relatively small scale compared to open surgery, significantly shortening recovery time.[151] They can also be used to avoid exposing workers to the hazardous and tight spaces such as in duct cleaning. When disabling a bomb, the operator sends a small robot to disable it. Several authors have been using a device called the Longpen to sign books remotely.[154] Teleoperated robot aircraft, like the Predator Unmanned Aerial Vehicle, are increasingly being used by the military. These pilotless drones can search terrain and fire on targets.[155][156] Hundreds of robots such as iRobot's Packbot and the Foster-Miller TALON are being used in Iraq and Afghanistan by the U.S. military to defuse roadside bombs or improvised explosive devices (IEDs) in an activity known as explosive ordnance disposal (EOD).[157]Robots are used to automate picking fruit on orchards at a cost lower than that of human pickers.The Roomba domestic vacuum cleaner robot does a single, menial job.Domestic robots are simple robots dedicated to a single task work in home use. They are used in simple but often disliked jobs, such as vacuum cleaning, floor washing, and lawn mowing. An example of a domestic robot is a Roomba.Main article: Military robotMilitary robots include the SWORDS robot which is currently used in ground-based combat. It can use a variety of weapons and there is some discussion of giving it some degree of autonomy in battleground situations.[158][159][160]Unmanned combat air vehicles (UCAVs), which are an upgraded form of UAVs, can do a wide variety of missions, including combat. UCAVs are being designed such as the BAE Systems Mantis which would have the ability to fly themselves, to pick their own course and target, and to make most decisions on their own.[161] The BAE Taranis is a UCAV built by Great Britain which can fly across continents without a pilot and has new means to avoid detection.[162] Flight trials are expected to begin in 2011.[163]The AAAI has studied this topic in depth[110] and its president has commissioned a study to look at this issue.[164]Some have suggested a need to build "Friendly AI", meaning that the advances which are already occurring with AI should also include an effort to make AI intrinsically friendly and humane.[165] Several such measures reportedly already exist, with robot-heavy countries such as Japan and South Korea[166] having begun to pass regulations requiring robots to be equipped with safety systems, and possibly sets of 'laws' akin to Asimov's Three Laws of Robotics.[167][168] An official report was issued in 2009 by the Japanese government's Robot Industry Policy Committee.[169] Chinese officials and researchers have issued a report suggesting a set of ethical rules, and a set of new legal guidelines referred to as "Robot Legal Studies."[170] Some concern has been expressed over a possible occurrence of robots telling apparent falsehoods.[171]Mining robots are designed to solve a number of problems currently facing the mining industry, including skills shortages, improving productivity from declining ore grades, and achieving environmental targets. Due to the hazardous nature of mining, in particular underground mining, the prevalence of autonomous, semi-autonomous, and tele-operated robots has greatly increased in recent times. A number of vehicle manufacturers provide autonomous trains, trucks and loaders that will load material, transport it on the mine site to its destination, and unload without requiring human intervention. One of the world's largest mining corporations, Rio Tinto, has recently expanded its autonomous truck fleet to the world's largest, consisting of 150 autonomous Komatsu trucks, operating in Western Australia.[172] Similarly, BHP has announced the expansion of its autonomous drill fleet to the world's largest, 21 autonomous Atlas Copco drills.[173]Drilling, longwall and rockbreaking machines are now also available as autonomous robots.[174] The Atlas Copco Rig Control System can autonomously execute a drilling plan on a drilling rig, moving the rig into position using GPS, set up the drill rig and drill down to specified depths.[175] Similarly, the Transmin Rocklogic system can automatically plan a path to position a rockbreaker at a selected destination.[176] These systems greatly enhance the safety and efficiency of mining operations.Robots in healthcare have two main functions. Those which assist an individual, such as a sufferer of a disease like Multiple Sclerosis, and those which aid in the overall systems such as pharmacies and hospitals.Further information: Disability robotThe Care-Providing Robot FRIENDRobots used in home automation have developed over time from simple basic robotic assistants, such as the Handy 1,[177] through to semi-autonomous robots, such as FRIEND which can assist the elderly and disabled with common tasks.The population is aging in many countries, especially Japan, meaning that there are increasing numbers of elderly people to care for, but relatively fewer young people to care for them.[178][179] Humans make the best carers, but where they are unavailable, robots are gradually being introduced.[180]FRIEND is a semi-autonomous robot designed to support disabled and elderly people in their daily life activities, like preparing and serving a meal. FRIEND make it possible for patients who are paraplegic, have muscle diseases or serious paralysis (due to strokes etc.), to perform tasks without help from other people like therapists or nursing staff.Main article: Pharmacy automationThis section needs additional citations for verification. Please help improve this article by adding citations to reliable sources in this section. Unsourced material may be challenged and removed. (July 2009) (Learn how and when to remove this message)Script Pro manufactures a robot designed to help pharmacies fill prescriptions that consist of oral solids or medications in pill form.[181][bettersourceneeded] The pharmacist or pharmacy technician enters the prescription information into its information system. The system, upon determining whether or not the drug is in the robot, will send the information to the robot for filling. The robot has 3 different size vials to fill determined by the size of the pill. The robot technician, user, or pharmacist determines the needed size of the vial based on the tablet when the robot is stocked. Once the vial is filled it is brought up to a conveyor belt that delivers it to a holder that spins the vial and attaches the patient label. Afterwards it is set on another conveyor that delivers the patient's medication vial to a slot labeled with the patient's name on an LED read out. The pharmacist or technician then checks the contents of the vial to ensure it's the correct drug for the correct patient and then seals the vials and sends it out front to be picked up.McKesson's Robot RX is another healthcare robotics product that helps pharmacies dispense thousands of medications daily with little or no errors.[182] The robot can be ten feet wide and thirty feet long and can hold hundreds of different kinds of medications and thousands of doses. The pharmacy saves many resources like staff members that are otherwise unavailable in a resource scarce industry. It uses an electromechanical head coupled with a pneumatic system to capture each dose and deliver it to either its stocked or dispensed location. The head moves along a single axis while it rotates 180 degrees to pull the medications. During this process it uses barcode technology to verify it's pulling the correct drug. It then delivers the drug to a patient specific bin on a conveyor belt. Once the bin is filled with all of the drugs that a particular patient needs and that the robot stocks, the bin is then released and returned out on the conveyor belt to a technician waiting to load it into a cart for delivery to the floor.See also: Robotics researchWhile most robots today are installed in factories or homes, performing labour or life saving jobs, many new types of robot are being developed in laboratories around the world. Much of the research in robotics focuses not on specific industrial tasks, but on investigations into new types of robot, alternative ways to think about or design robots, and new ways to manufacture them. It is expected that these new types of robot will be able to solve real world problems when they are finally realized.[citation needed]Further information: BiomimeticsFurther information: BionicsOne approach to designing robots is to base them on animals. BionicKangaroo was designed and engineered by studying and applying the physiology and methods of locomotion of a kangaroo.Further information: NanoroboticsNanorobotics is the emerging technology field of creating machines or robots whose components are at or close to the microscopic scale of a nanometer (109 meters). Also known as "nanobots" or "nanites", they would be constructed from molecular machines. So far, researchers have mostly produced only parts of these complex systems, such as bearings, sensors, and synthetic molecular motors, but functioning robots have also been made such as the entrants to the Nanobot Robocup contest.[183] Researchers also hope to be able to create entire robots as small as viruses or bacteria, which could perform tasks on a tiny scale. Possible applications include micro surgery (on the level of individual cells), utility fog,[184] manufacturing, weaponry and cleaning.[185] Some people have suggested that if there were nanobots which could reproduce, the earth would turn into "grey goo", while others argue that this hypothetical outcome is nonsense.[186][187]Main article: Self-reconfiguring modular robotA few researchers have investigated the possibility of creating robots which can alter their physical form to suit a particular task,[188] like the fictional T-1000. Real robots are nowhere near that sophisticated however, and mostly consist of a small number of cube shaped units, which can move relative to their neighbours. Algorithms have been designed in case any such robots become a reality.[189]Further information: Laboratory roboticsIn July 2020 scientists reported the development of a mobile robot chemist and demonstrate that it can assist in experimental searches. According to the scientists their strategy was automating the researcher rather than the instruments freeing up time for the human researchers to think creatively and could identify photocatalyst mixtures for hydrogen production from water that were six times more active than initial formulations. The modular robot can operate laboratory instruments, work nearly around the clock, and autonomously make decisions on his next actions depending on experimental results.[190][191]Robots with silicone bodies and flexible actuators (air muscles, electroactive polymers, and ferrofluids) look and feel different from robots with rigid skeletons, and can have different behaviors.[192] Soft, flexible (and sometimes even squishy) robots are often designed to mimic the biomechanics of animals and other things found in nature, which is leading to new applications in medicine, care giving, search and rescue, food handling and manufacturing, and scientific exploration.[193][194]Main article: Swarm roboticsInspired by colonies of insects such as ants and bees, researchers are modeling the behavior of swarms of thousands of tiny robots which together perform a useful task, such as finding something hidden, cleaning, or spying. Each robot is quite simple, but the emergent behavior of the swarm is more complex. The whole set of robots can be considered as one single distributed system, in the same way an ant colony can be considered a superorganism, exhibiting swarm intelligence. The largest swarms so far created include the iRobot swarm, the SRI/MobileRobots CentiBots project[195] and the Open-source Micro-robotic Project swarm, which are being used to research collective behaviors.[196][197] Swarms are also more resistant to failure. Whereas one large robot may fail and ruin a mission, a swarm can continue even if several robots fail. This could make them attractive for space exploration missions, where failure is normally extremely costly.[198]Further information: Haptic technologyRobotics also has application in the design of virtual reality interfaces. Specialized robots are in widespread use in the haptic research community. These robots, called "haptic interfaces", allow touch-enabled user interaction with real and virtual environments. Robotic forces allow simulating the mechanical properties of "virtual" objects, which users can experience through their sense of touch.[199]Further information: Robotic artRobots are used by contemporary artists to create works that include mechanical automation. There are many branches of robotic art, one of which is robotic installation art, a type of installation art that is programmed to respond to viewer interactions, by means of computers, sensors and actuators. The future behavior of such installations can therefore be altered by input from either the artist or the participant, which differentiates these artworks from other types of kinetic art.Le Grand Palais in Paris organized an exhibition "Artists & Robots", featuring artworks created by more than forty artists with the help of robots in 2018.[200]Toy robots on display at the Museo del Objeto del Objeto in Mexico CitySee also: List of fictional robots and androids and Droid (Star Wars)Main article: Robots in literatureRobotic characters, androids (artificial men/women) or gynoids (artificial women), and cyborgs (also "bionic men/women", or humans with significant mechanical enhancements) have become a staple of science fiction.The first reference in Western literature to mechanical servants appears in Homer's Iliad. In Book XVIII, Hephaestus, god of fire, creates new armor for the hero Achilles, assisted by robots.[201] According to the Rieu translation, "Golden maidservants hastened to help their master. They looked like real women and could not only speak and use their limbs but were endowed with intelligence and trained in handwork by the immortal gods." The words "robot" or "android" are not used to describe them, but they are nevertheless mechanical devices human in appearance. "The first use of the word Robot was in Karel apek's play R.U.R. (Rossum's Universal Robots) (written in 1920)". Writer Karel apek was born in Czechoslovakia (Czech Republic).Possibly the most prolific author of the twentieth century was Isaac Asimov (19201992)[202] who published over five-hundred books.[203] Asimov is probably best remembered for his science-fiction stories and especially those about robots, where he placed robots and their interaction with society at the center of many of his works.[204][205] Asimov carefully considered the problem of the ideal set of instructions robots might be given to lower the risk to humans, and arrived at his Three Laws of Robotics: a robot may not injure a human being or, through inaction, allow a human being to come to harm; a robot must obey orders given it by human beings, except where such orders would conflict with the First Law; and a robot must protect its own existence as long as such protection does not conflict with the First or Second Law.[206] These were introduced in his 1942 short story "Runaround", although foreshadowed in a few earlier stories. Later, Asimov added the Zeroth Law: "A robot may not harm humanity, or, by inaction, allow humanity to come to harm"; the rest of the laws are modified sequentially to acknowledge this.According to the Oxford English Dictionary, the first passage in Asimov's short story "Liar!" (1941) that mentions the First Law is the earliest recorded use of the word robotics. Asimov was not initially aware of this; he assumed the word already existed by analogy with mechanics, hydraulics, and other similar terms denoting branches of applied knowledge.[207]Main article: Robot competitionRobots are used in a number of competitive events. Robot combat competitions have been popularized by television shows such as Robot Wars and BattleBots, featuring mostly remotely controlled 'robots' that compete against each other directly using various weaponry, there are also amateur robot combat leagues active globally outside of the televised events. Micromouse events, in which autonomous robots compete to solve mazes or other obstacle courses are also held internationally.Robot competitions are also often used within educational settings to introduce the concept of robotics to children such as the FIRST Robotics Competition in the US.See also: Category:Films about robotsRobots appear in many films. Most of the robots in cinema are fictional. Two of the most famous are R2-D2 and C-3PO from the Star Wars franchise.Main article: Sex robotThe concept of humanoid sex robots has drawn public attention and elicited debate regarding their supposed benefits and potential effects on society. Opponents argue that the introduction of such devices would be socially harmful, and demeaning to women and children,[208] while proponents cite their potential therapeutical benefits, particularly in aiding people with dementia or depression.[209]Italian movie The Mechanical Man (1921), the first film to have shown a battle between robotsFears and concerns about robots have been repeatedly expressed in a wide range of books and films. A common theme is the development of a master race of conscious and highly intelligent robots, motivated to take over or destroy the human race. Frankenstein (1818), often called the first science fiction novel, has become synonymous with the theme of a robot or android advancing beyond its creator.Other works with similar themes include The Mechanical Man, The Terminator, Runaway, RoboCop, the Replicators in Stargate, the Cylons in Battlestar Galactica, the Cybermen and Daleks in Doctor Who, The Matrix, Enthiran and I, Robot. Some fictional robots are programmed to kill and destroy; others gain superhuman intelligence and abilities by upgrading their own software and hardware. Examples of popular media where the robot becomes evil are 2001: A Space Odyssey, Red Planet and Enthiran.The 2017 game Horizon Zero Dawn explores themes of robotics in warfare, robot ethics, and the AI control problem, as well as the positive or negative impact such technologies could have on the environment.Another common theme is the reaction, sometimes called the "uncanny valley", of unease and even revulsion at the sight of robots that mimic humans too closely.[109]More recently, fictional representations of artificially intelligent robots in films such as A.I. Artificial Intelligence and Ex Machina and the 2016 TV adaptation of Westworld have engaged audience sympathy for the robots themselves.Final scene of R.U.R., ActIIEmancipation or revolution as a theme in relation to robots was already present in the term coining play of R.U.R.The Star Wars universe for example has several instances of droid revolts.The Dune series on the other hand has the premise of humans revolting against thinking machines and finding human-biological alternatives to them.Index of robotics articlesOutline of roboticsArtificial intelligenceWilliam Grey WalterRobot locomotionSimultaneous localization and mappingTactile sensorTeleoperationUncanny valleyvon Neumann machineWake-up robot problemNeuromorphic engineeringCognitive roboticsCompanion robotDomestic robotEpigenetic roboticsEvolutionary roboticsHumanoid robotAutonomous robotSwarm roboticsMicroboticsRobot controlAIBOAutonomous spaceport drone shipDriverless carFriendly RoboticsLely Juno familyLiquid handling robotParo (robot)PatrolBotRoboBeeRoboriorRobot App StoreAutomated guided vehicleAnimatronicsRemote control vehicleRobot AwardRobot economicsRobotoidUnmanned vehicleHybrotBiohybrid robotAl-Arshani, Sarah (29 November 2021). 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S2CID1962455.Wikiquote has quotations related to Robot.Journal of Field RoboticsRobot at Wikipedia's sister projects:Definitions from WiktionaryMedia from CommonsTextbooks from WikibooksResources from WikiversityRetrieved from " 21970s - 1990s Educational ToyThis article is about the toy. For other uses, see 2XL.2-XLThe 2-XL version with its cassette tapes distributed by Tiger Electronics in 1992. A European version distributed by Tomy is seen here.Other names2-XL Robot, 2XL Robot, 2XLTypeEducational toy robotInvented byMichael J. FreemanCompanyMego Corporation (19781981)Tiger Electronics (19921995)CountryUnited StatesAvailability19781981; 199219952-XL (2-XL Robot, 2XL Robot, 2-XL Toy) is an educational toy robot that was marketed from 19781981[1] by the Mego Corporation, and from 19921995 by Tiger Electronics. 2-XL was the first "smart-toy" in that it exhibited rudimentary intelligence, memory, gameplay, and responsiveness.[2][3] 2-XL was infused with a "personality" that kept kids focused and challenged as they interacted with the verbal robot. Learning was enhanced via the use of jokes and funny sayings as verbal reinforcements for performance. 2-XL was heralded as an important step in the development of toys, particularly educational ones. 2-XL won many awards, and Playthings, a toy industry magazine, placed 2-XL on its 75th anniversary cover as one of the industry's top-ten toys of all time.[4] The 2-XL name is a pun of the phrase "to excel".[5]The toy was invented and licensed for manufacture by Michael J. Freeman, inventor, Ph.D. and was patented.[6] 2-XL exhibited rudimentary intelligence, memory, gameplay, and responsiveness. Dubbed the "Toy with a Personality", 2-XL could respond verbally to the user depending upon which "input or answer" buttons were chosen.[7] 2-XL during its run was one of the most popular toys in terms of market revenue and was dubbed the Talking Robot with a mind of its own.[8] The toy was voiced by Freeman,[9] using a synthesizer to make his voice a high-pitched robot-like sound; it was through this process that Freeman developed 2-XL's personality. 2-XL was first introduced in 1978 by the Mego Corporation, a publicly traded US-based toy company in New York City[10] and it subsequently became a success.[10][11][12] The toy was sold in different countries and the tapes were translated into seven foreign languages.[13] Games were also developed for the toy.[10]Mego, otherwise known for its production of dolls and classic action figures in the 1970s, was seen as an innovator combining toys and education. The toy's name literally meant "To Excel". The toy was voice capable, was able to tell stories, and sing using its special 8-track tapes. The toy's tapes asked multiple-choice questions (MCQs) that were answered by pushing a YES or NO button that changed the tracking of the tape. It was a crude but reportedly innovative use of the technology that was present in that era.[14]In addition to its general popularity, 2-XL was unprecedented in terms of market revenue.[15][16][17] Playthings magazine, in its cover story of September 1978, considered the 2-XL robot as one of the most important toys ever developed, and included it in a class of "toys with impact" along with the Teddy Bear, Barbie Doll, Raggedy Ann, Mickey Mouse among others.[4] The robot was a popular educational toy whose success anticipated the dominant influence of technology in education today.[18] Dubbed the "Toy with a Personality", 2-XL could respond verbally to the user depending upon which "input or answer" buttons were chosen.[19] Part of the reason for this is the connection the toy made between education and fun.[15]2-XL was interactive playing various tracks from a magnetic audio tape depending on the user's actions. 2-XL's personality was popular and kids loved the back-and-forth banter. For example, if a child got an answer wrong 2-XL might utter something like "Perhaps your brain went on strike! You are Wrong" or, "Nice try but (whispering) you are wrong, but go ahead, I will be a nice little toy robot and give you a second chance now". Other lines from 2-XL included: "Even though you needed two chances you finally got the answer right, elephant is the correct answer"'; "But do not get too excited, you have now earned yourself a more difficult question. Hold on to your hat, here it comes". If the child was right, 2-XL might say: "Although I have the looks you have the brains. You must be a genius. Good work", or, "It is amazing that big brain of yours fits into the head of a child. Nice answer, football is correct".[20]In 1981, the toy's popularity waned, and it was later discontinued.[10] In 1992, 2-XL was re-introduced by Tiger Electronics, a toy company based in Vernon Hills, Illinois.[21] The toy was changed into a more modern design, and new programmed toy cartridges were also introduced.[22] The voice for this version was done by Freeman as well, and all programs were translated into many different languages.The 2-XL educational toy robot by Mego Corporation in 1978The original version, created by Mego Corporation, was made of brown plastic with white plastic found on the anterior face of the robot. It had two red light bulbs for the eyes. These bulbs also flashed at moments while 8-track cartridge tape programs played. It had four red buttons on its stomach with designated options for answers to questions asked by the toy, such as "Question", "A or Yes Or True", "B or More Info", and "C or No or False" (NOTE: Some programs came with overlay cards for the buttons that redefined the choices the user could make for that specific program). A knob is also found on the lower right portion of the toy which controlled its volume and power. The "mouth" was reused detail molding taken from the Micronauts Battle Cruiser. At the bottom was a large slot for 8-track cartridge tapes: this version was essentially a regular 8-track tape player, but by employing mathematical decision tree programming methods over 20 interactive modes of operation were achieved.[23] The result had enough information and interactive questions to entertain and educate a person for up to two hours. Subjects included sports quiz, Guinness Book of World Records, the metric system, general information and jokes.Another version of the 2-XL robotThe mold and look received a minor revision in 1980. The eye lights became red and responded to the voice. The flashing lights were also brighter, and the speaker in the back of the unit was changed from a hexagon shape to a more traditional round. The plastic had a glossier appearance. There was a modified version of 2-XL made just for schools with extra earphone jacks, specialty tapes for school curricula, and a teacher's manual to go with each educational tape.[24]A 2-XL X-Men cassette tape.Tiger Electronics re-introduced 2-XL in 1992. Instead of using 8-track cartridge tapes, this version used cassette tapes that were twice the length of the tapes in the previous version and had a better sound quality.[25] Freeman again recorded the 2-XL voice for the cassette tapes in a professional sound studio.[13] In addition to eyes that would light up, the toy now sported a circle for a mouth that could light up as the machine talked. The toy could now run on batteries and had a headphone jack. Instead of the buttons simply switching tracks on the 8-track tape as in the old version, the cassette version took advantage of the fact that a cassette has a total of four tracks - one for the left and right channel on each side. The tape head in the player could play any of the four parallel tracks, based on which button was pressed. Playing a 2-XL tape in a standard tape player would result in different audio on the left and right channels, and if the reverse side was played, one would hear the other two tracks played in reverse. Using all four tracks simultaneously in one direction was not unique in toys to the 2-XL since the concept had been borrowed from the Talk 'n Play educational system in existence from 1983-1992 and provided the basis for the interactive give and take on both toys.[25] That concept in turn had been borrowed both from early home-portastudio cassette recorders with the built-in mixing board used by garage bands to put their demos together to try and get hired or get a record deal. The earliest instances were the 4.0 surround sound cassette experiments in the mid '70s to again try to supplant with a cassette counterpart the quadraphonic 8-track (which was just as prone to breaking and jamming as the original 2-XL tapes).As with the previous version, this version could play any standard type of similar tape, but the user needed to first push the "Question" button (or the "2/A/No" button would work as well, playing the correct (left/dominant) channel of the (forward/A-side) of the program. Pressing buttons labeled 3 or 4 would play the left or right channel of the B-side of the tape in reverse.Newly released tapes were branded with famous fictional characters and popular film and TV properties, including Spider-Man, X-Men, Star Trek: The Next Generation, Mighty Morphin' Power Rangers, Are You Afraid of the Dark?, Tales from the Cryptkeeper, Jurassic Park, Superman and Batman. These particular 2-XL programs would allow the user to go on an adventure with various characters, deciding their fate by pushing one of the buttons (much like the old Choose Your Own Adventure books).The second version was on the market from 1992 through 1996, and about 45 tapes were released in total. The toy was sold internationally, including in Japan, Germany, Hungary, Italy, France, UK, Ireland, Canada, Brazil (where it was distributed by Nintendo's official local licenser Playtronic) and others. The tapes were translated into many foreign languages, but were not recorded by Freeman.A German Speaking 2-XL Robot ProgramThe toy's success was also the basis for a game show called Pick Your Brain produced by Marc Summers Productions and Summit Media Group. The 2-XL robot in the show served as the assistant of Marc Summers. 2-XL was also a spokesrobot for basketball player Michael Jordan and his charitable foundation in 1992 and 1993 and appeared in a number of PSA (public service announcements) with Jordan.[26][27]General Information was included with each toy robot. The remainder programs were each sold separately:50's and 60's Nostalgia (1978)Adult Games and Puzzles (1978)Animal World (1978)Astronomy: 2-XL in Space (1978)The Basics of ABCs (1978)Believe This or Not (1978)Games and Puzzles Number 1 (1978)General Information 2 (1978)General Information 3 (1978)Guinness Book of World Records (1978)Interviews with Great People from History (1978)Metric System Education (1978)Monsters, Myths and Legends (1978)Reading, Writing and Arithmetic (1978)Science Fiction (1978)Sports (1978)Sports 2 (1978)Storyland (1978)Storyland: 2-XL and the Time Machine (1978)US Presidents and American History (1978)Exercise with 2-XL (1979)Fairy Tale Quiz (1979)Math and Number Games (1979)Pre-School Facts and Fantasies (1979)Science Fiction 2 (1979)Strange but Is Is It True (1979)Super Heroes and Comic Books Cavalcade (1979)Talking Calculator and Number Game (1979)Tid Bits and Funny Facts (1979)Tri-Lex (1979) - a simulated game-playing AITV and Movie Challenges (1979)Who Said It (1979)Wonders of the World (1979)Robotrivia (1980) - two tape set including a board game.Robotstronomy (1980) - two tape set including a board game.Word and Sound Games (1980) - two tape set.Amazing Sports Feats (1981)Amazing World of the Small (1981)Bet Your Life (1981)Challenges of General Science (1981)General Information Revised (1981) - used the same label as the original General Information including the date of 1978.Pre-school Bed Time Stories (1981)Traffic and Bicycle Safety (1981)The World of 2-XL was sold with each toy robot. The remainder programs were each sold separately. For foreign sales, the Freeman voiced 2-XL English language tapes were translated into foreign languages performed by a professional that spoke the designated language. Sportsworld (1992)Fun and Games (1992)World of Animals (1992)World of Science (1992)Monsters, Myths, & Dinosaurs (1992)Trivia Time (1992)Amazing World's Records (1992)Fascinating Facts (1992)Storymaker (1992)African Safari (1993)Jurassic Facts (1993)Batman: Carnival of Crime (1993)Treasure Chest of Facts and Fun (1993)Voyage to Outer Space (1993)Batman: The Sizzling Scheme (1993)Music Maker (1993)Oceans of Fun (1993)Planet Earth (1993)Pet Parade (1993)Letter Perfect (1993)Count On It (1994) - Scholastic Series[28]Food Facts and You (1994)Chaos in Jurassic Park (1994)Fun With Words (1994) - Scholastic SeriesIncredible Sports Feats (1994)Are You Afraid of the Dark - Nickelodeon (1994)Geography & You (1994)Power Rangers (1994)All-Time Top Topics (1994)Careers & You (1994)Nature & You (1994)Ripley's Believe It Or Not!: The Strange & True! (1994)Safety First (1994)Say Hello to Famous Folks (1994)Spider-Man: For King and Country (1994)Stars and Planets Game (1994)Star Trek - The Next Generation: Blinded by the Light (1994)Superman - The Man of Steel: Mayhem in Metropolis (1994)Superman - The Man of Steel: A New Hero In Town (1994)Surprise Package (1994)X-Men: Deadly Games (1994)X-Men: Ghosts That Haunt Us (1994)Tales From The Cryptkeeper: If Wishes Were Hornets (1994)One of the last tapes released for the Mego Corporation version of 2XL was "Trilex", a complete board game designed to be played against 2XL. The tape came with a board which fitted over the front of the 2XL unit itself, with the board in front of the tape slot. The game board consisted of an inverted pyramid shape, 4 squares wide at the top to 1 square at the bottom, with each row colored in a different color (Blue, Yellow, Green, and Tan), and 4 slots through which pieces (which 2XL called "checkers") could be dropped into the pyramid. The slots aligned with 2XL's 4 buttons, with the intention that dropping the checker would also press the appropriate track button on 2XL. The objective of the game was to create either a line or a triangle of three checkers of a selected color. The game and tape design are interesting because they enabled the 4-track tape player to provide a passable simulation of a game-playing AI.[29]A number of secondary products were licensed under the 2-XL (2XL) name including: laptop computer bags, earphones, lunch boxes and more.[30]During its time, both iterations of 2-XL won hundreds of awards, including FamilyFun magazine's award for best toy of 1992, and Right Start Magazine's honor as Europe's best toy in the 3-5 year-old category for 1993. For the 75th anniversary issue of Playthings magazine, 2-XL was featured on the cover and named one of the top ten toys of all time. The Tiger 2-XL was also the winner of the 1992 Walt Disney Company Best Learning Toy for 1992.[31]Talk 'n Play, another toy created by Dr. Freeman^ Coopee, Todd (September 8, 2015). "2-XL Talking Robot". ToyTales.ca.^ Gardner, Howard. "Mego 2-XL Talking Robot". Psychology Today (1979): 93.^ Jake Rossen (October 13, 2016). "Remembering the First Smart Toy: 2-XL". mentalfloss.com. Archived from the original on October 14, 2016.^ a b "75 Years of Toys" Playthings Magazine, September 2008, Volume 9, Cover page Story. Progressive Business Media. Retrieved October 11, 2011.^ "The kids' Whole Earth Catalogue, Random House book, 1982, ISBN 0-394-85090-4^ "US Patent 4078316 A: Real Time Conversational Toy". IFI CLAIMS Patent Services. Google Patents. March 14, 1978. Retrieved December 7, 2013.^ "BEST & WORST D Magazine". www.dmagazine.com. January 1980. Retrieved January 23, 2017.^ "2-XL Talking Robot by Tiger Electronics - The Old Robots Web Site". www.theoldrobots.com. 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Freeman.Unofficial 2-XL Page2-XL Simulator an online web simulator with dozens of the original cartridges.2XLBot.com - updated and complete version of the above site.The original 2-XL patent retrieved from Google PatentsThe Old RobotsRetrieved from " 3The following pages link to 2-XL External tools(link counttransclusion countsorted list) See help page for transcluding these entriesShowing 30 items.View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Robot (links | edit)8-track cartridge (links | edit)Tiger Electronics (links | edit)Mego Corporation (links | edit)2XL (links | edit)Pick Your Brain (links | edit)Educational toy (links | edit)Playtronic (links | edit)Kasey the Kinderbot (links | edit)Michael J. Freeman (links | edit)2-XL robot (redirect page) (links | edit)2XL robot (redirect page) (links | edit)Talk:2-XL (transclusion) (links | edit)User:Johnruble (links | edit)User:Skaur.wiki/sandbox (links | edit)User:JoannaPaulaC/sandbox/Michael J. Freeman (links | edit)User:Laura 081/sandbox (links | edit)User:CoolNE1234/Educational toy (links | edit)User talk:Eshire1 (links | edit)User talk:Fkejjr (links | edit)User talk:108.36.134.24 (links | edit)Wikipedia:Copyright problems/2007 June 12/Images (links | edit)Wikipedia:WikiProject Academic Journals/Journals cited by Wikipedia/A17 (links | edit)Wikipedia:WikiProject Spam/LinkReports/toytales.ca (links | edit)Wikipedia:Wiki Ed/Louisiana State University/English 1001 (Fall 2015) (links | edit)Wikipedia:WikiProject Toys/Popular pages (links | edit)Wikipedia:WikiProject Academic Journals/Journals cited by Wikipedia/N32 (links | edit)Wikipedia:WikiProject Academic Journals/Journals cited by Wikipedia/Questionable1 (links | edit)File:2-XLx-men casette.jpg (links | edit)File:2-XL Ed (packaging).jpg (links | edit)View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Retrieved from " WhatLinksHere/2-XL" A robot is a machine(especially a programmable robot) that can sense its environment, carry out computations to make decisions and perform tasks in the real world.Given below are some of the interesting and funny facts about robots!A robot is a machine that can perform tasks humans do. A robot is programmed by a computer and hence one of the applications of computer programming.Robots are programmed with instructions that guide the robots to execute the tasks it is expected to perform.The term Robot has been derived from the Czech word Robota which means hard work and forced labor.A robot can only do what it is programmed to do.John McCarthy first coined the term Artificial Intelligence in 1956.Clocky is a robotic alarm clock that runs away from you while playing the alarm sound so that you get out of the bed to stop it!According to the Experts, human-robot marriage will be legal by 2050.According to a study, Japan will have 1 million of industrial robots by the year 2025.A robot named Shakey became the first robot to use artificial intelligence to make its own decisions in 1966.There is a small category of robot called a nanobot. It is less than one-thousandth of a millimeter.An Italian movie named The Mechanical Man was the first movie to show robot fights. The movie was produced in 1921.Sensors like microphones, video cameras, and photoresistors provide a robot with the ability to communicate with the outer world.A Robot gets the ability to communicate with the outer world with the help of microphones, video cameras, and different types of sensors.The highest level of robot density in the world is in South Korea with 631 robots per 10,000 employees.The average robot density in Europe is 99 per 10,000 employees and in America, it is 84 robots per 10,000 employees.In some cases, robots are able to manipulate human emotions. In an experiment, a robot begged not to turn it off. While 30% of people agreed with the robot, the researcher refused!Sophia is the first humanoid robot to get country citizenship from Saudi Arabia. It was created by Hanson Robotics. The robot uses facial recognition, visual data processing and can imitate human gestures and expressions.There is a phobia named as Robophobia which is an anxiety disorder in which a person has a fear of robots.Most of us have played the rock paper scissors game. But, did you know that there is a robot that wins rock paper scissors 100% of the time. Its name is Janken!Android is another term used to point a robot!The term Android refers only to a male looking robot. In contrast, Gynoid is the term for a female robot.The worlds most expensive robot is Asimo. It was created by Honda and the cost to build the robot was around 2.5 million dollars.The Ecobots turns biological wastes into energy.A robot named Robear is a robotic nurse developed by a Japanese company. It has a gentle touch.A programmable robot must have a Central Processing Unit and a Control System. Apart from these, a robot has motors combined with other hardware parts for the movements of the robot as per the commands.It is important to consider safety, weight and lifecycle factors while designing a robot.A robot can be assigned activities that may seems to be difficult to be assigned to a normal human being. They could be exploring inside a gas tank, traveling Mars, exploring a volcano, or a hazardous contaminated environment.There was a robot named Raptor that can run twice as fast as a human.A robot is programmed using a programming language. The most popular programming languages used in robotics are C and C++. Apart from these there are Python, Java, MATLAB, LISP, and C#. The structure of a robot is usually mostly mechanical and is called a kinematic chain (its functionally similar to the skeleton of human body). The chain is formed of links (its bones), actuators (its muscles) and joints which can allow one or more degrees of freedom.Some robots use open serial chains in which each link connects the one before to the one after it. Robots used as manipulators have an end effectors mounted on the last link. This end effectors can be anything from a welding device to a mechanical hand used to manipulate the environment.basic components of robotsMajor Components of Robots 1. Actuation:Actuation is the muscles of a robot, the parts which convert stored energy into movement. The most popular actuators are electric motors.2. Motors:The vast majority of robots use electric motors, including bushed and brushies DC motors.3. Stepper motors:Stepper motors do not spin freely like DC motors; they rotate in discrete steps, under the command of a controller. This makes them easier to control.4. Piezo Motors:A recent alternative to DC Motors are piezo motors or ultrasonic motors. Tiny piezoceramic elements, vibrating many thousands of times per second, cause linear or rotary motion.5. Air Muscles:The air muscle in a simple yet powerful device for providing a pulling force. It behaves in a very similar way to a biological muscle; it can be used to construct robots with a similar muscle/skeleton system to an animal.6. Electroactive polymers:Are classes of plastics which change shape in response to electric stimulation.7. Elastic Nanotubes:The absence of defects in nanotubes enables these filaments to deform elastically by several percent.8. Manipulation:Robots work in the real world require some way to manipulate objects; pick up, modify, destroy or otherwise have an effect. Thus, the hands, of a robot are often referred to as end effectors. Most robots arms are replaceable effectors, each allowing them to perform some small range of tasks. Some have a fixed manipulator which cannot be replaced, while a few have one very general purpose manipulator. link to Top Branches of Mechanical Engineering link to Shree Ram Ayodhya Murti, idol - Vector , Wallart Share copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. A robot is a machine that functions automatically and can adapt to changes in its environment. Although the word "robot" was first used in Czech writer Karl Capek's 1921 play, "Rossum's Universal Robots," human beings have been tinkering with machines that run without human guidance since the time of the Pharaohs. A staple of science fiction, robots are an increasingly important segment of our society, performing many jobs that are too dangerous or tedious for human beings. At the most basic level, human beings and other animals survive through a principle called feedback. Human beings sense what is going on around them and react accordingly. The use of feedback to control how a machine functions dates back to at least 1745, when English lumber mill owner Edmund Lee used the principle to improve the function of his wind-powered mill. Every time the wind changed direction, his workers had to move the windmill to compensate. Lee added two smaller windmills to the larger one. These smaller windmills powered an axle that automatically turned the larger one to face the wind.A robot's control system uses feedback just as the human brain does. However, instead of a collection of neurons, a robot's brain consists of a silicon chip called a central processing unit, or CPU, that is similar to the chip that runs your computer. Our brains decide what to do and how to react to the world based on feedback from our five senses. A robot's CPU does the same thing based on data collected by devices called sensors. Robots receive feedback from sensors that mimic human senses such as video cameras or devices called light-dependent resistors that function like eyes or microphones that act as ears. Some robots even have touch, taste and smell. The robot's CPU interprets signals from these sensors and adjusts its actions accordingly. To be considered a robot, a device must have a body that it can move in reaction to feedback from its sensors. Robot bodies consist of metal, plastic and similar materials. Inside these bodies are small motors called actuators. Actuators mimic the action of human muscle to move parts of the robot's body. The simplest robots consist of an arm with a tool attached for a particular task. More advanced robots may move around on wheels or treads. Humanoid robots have arms and legs that mimic human movement. In order to function a robot must have power. Human beings get their energy from food. After we eat, the food is broken down and converted into energy by our cells. Most robots get their energy from electricity. Stationary robotic arms like the ones that work in car factories can be plugged in like any other appliance. Robots that move around are usually powered by batteries. Our robotic space probes and satellites are often designed to collect solar power. In order to interact with the environment and carry out assigned tasks, robots are equipped with tools called end effectors. These vary according to the tasks the robot has been designed to carry out. For example, robotic factory workers have interchangeable tools such as paint sprayers or welding torches. Mobile robots such as the probes sent to other planets or bomb disposal robots often have universal grippers that mimic the function of the human hand. III, Frank B. Chavez. "The Main Parts Of A Robot" sciencing.com, . 13 March 2018. APA III, Frank B. Chavez. (2018, March 13). The Main Parts Of A Robot. sciencing.com. Retrieved from Chicago III, Frank B. Chavez. The Main Parts Of A Robot last modified August 30, 2022. In todays rapidly evolving technological landscape, the development and integration of robots have become synonymous with innovation and efficiency. From manufacturing processes to healthcare services and beyond, robots have revolutionized various industries through their ability to automate tasks and perform intricate functions with precision. Understanding the essential components and features of robots is pivotal in unraveling the mechanics behind this modern technology. By delving into the intricacies of robotics, we can gain valuable insights into the design, capabilities, and potential applications of these cutting-edge machines. In this article, we will explore the fundamental components and features that underpin the functionality of robots, shedding light on the pivotal role they play in shaping the present and future of technological advancement.Key TakeawaysThe key components of a robot include a control system, sensors, actuators, power supply, and a body or frame. The control system directs the robots actions, while sensors provide information about the environment. Actuators enable movement, and the power supply supplies the necessary energy. Additionally, robots often feature programming and decision-making capabilities, enabling them to perform specific tasks autonomously.Fundamental Components Of RobotsThe fundamental components of robots encompass a range of crucial elements that enable these sophisticated machines to perform their designated tasks. At the core of every robot lies its mechanical structure, which consists of a body, actuators, sensors, and effectors. The body of a robot provides the framework for housing its internal components and enables physical interaction with its environment. Actuators, such as motors and pneumatic systems, are responsible for executing movements and actions, while sensors gather data from the robots surroundings and provide input for decision-making processes. The effectors, which can include grippers or tool attachments, allow the robot to interact with objects in its environment.Powering these components is the robots control system, which dictates the machines behavior through programmed instructions and feedback mechanisms. Additionally, the power supply, whether it be electrical, hydraulic, or pneumatic, is critical for operational functionality. Furthermore, the computational system, comprising onboard computers or microcontrollers, processes and interprets data from sensors, executing tasks with precision and accuracy. Together, these fundamental components form the foundation of robots, laying the groundwork for the efficiency and capabilities of modern robotic technology.Actuators And Sensors In RoboticsActuators and sensors form the backbone of robotic systems, enabling them to interact with the environment and perform tasks with precision. Actuators are responsible for converting electrical signals into mechanical motion, allowing robots to move, grip objects, and perform a wide range of actions. These components are crucial in achieving the dexterity and agility required for robots to carry out tasks efficiently.On the other hand, sensors are integral in providing robots with the ability to perceive and understand their surroundings. These sensory devices capture data from the environment, including information on distance, touch, temperature, and more. By processing this input, robots can make informed decisions, avoid obstacles, and interact with objects in a controlled and adaptive manner.The synergy between actuators and sensors is vital for the functionality and success of robotic systems in various applications, from manufacturing and logistics to healthcare and exploration. As technology advances, the development of more advanced and sophisticated actuators and sensors continues to drive innovation in the field of robotics, shaping the future of automation and intelligent machines.Control Systems And ProgrammingControl systems and programming are essential components of robots, allowing them to perform specific tasks with precision and efficiency. The control system is responsible for managing the robots movements and actions, utilizing sensors and feedback mechanisms to adjust its behavior in real-time. This enables robots to adapt to changing environments and interact safely with humans and other objects.Programming is the backbone of a robots functionality, determining its capabilities and behavior. Through programming, robots can execute complex sequences of tasks, process sensor data, and make autonomous decisions. This involves writing code to control the robots movements, interpret input from sensors, and respond to various stimuli. Advanced programming languages and algorithms play a crucial role in enabling robots to perform intricate tasks such as object manipulation, navigation, and even collaborative work with humans.In conclusion, control systems and programming are fundamental to the operation of robots, enabling them to function autonomously and carry out specific tasks in diverse environments. These components are constantly evolving, driving the advancement of robotic technology and its integration into various industries, from manufacturing and healthcare to exploration and beyond.Artificial Intelligence And Machine Learning In RobotsArtificial intelligence (AI) and machine learning play a pivotal role in shaping the capabilities of modern robots. These technologies empower robots to learn from and adapt to their environment, enabling them to perform complex tasks with greater efficiency and accuracy. Through AI and machine learning algorithms, robots can analyze data, make decisions, and even predict outcomes based on patterns and experiences, mirroring human cognitive abilities.Moreover, AI and machine learning equip robots with the ability to continuously improve through experience, making them more adept at handling diverse tasks and scenarios. This adaptive capability allows robots to optimize their performance over time, making them increasingly valuable in various industries such as manufacturing, healthcare, and logistics. As a result, the integration of AI and machine learning in robots is driving advancements in automation, efficiency, and overall productivity, revolutionizing the way businesses operate and enhancing human-robot collaboration.In summary, the incorporation of artificial intelligence and machine learning in robots not only amplifies their cognitive and decision-making capabilities but also facilitates their adaptation and continual improvement. This marks a significant leap in the evolution of robotics, empowering these machines to become more versatile, intelligent, and indispensable assets in the contemporary technological landscape.Power Sources For RobotsPower sources for robots are crucial for their functionality and operation. These power sources can vary depending on the type and application of the robot. Common power sources for robots include batteries, fuel cells, and electric power cords. Each of these sources has its advantages and limitations.Batteries are a popular choice for robots due to their portability and ease of use. However, they may need frequent recharging and have limited energy storage capacity. Fuel cells, on the other hand, offer high energy density and longer operational time but may be costly and require specific infrastructure for refueling. Electric power cords provide continuous energy supply but limit the mobility of the robot. Advancements in power sources for robots continue to evolve, with innovations in sustainable energy options such as solar power and kinetic energy harvesting, which can help prolong operational time and reduce environmental impact. Despite the diverse power sources available, selecting the most suitable one for a robot involves careful consideration of factors such as energy requirements, operational duration, and mobility.Mobility And Locomotion In RoboticsMobility and locomotion are crucial aspects in the field of robotics, enabling robots to navigate and operate in various environments. The design and implementation of mobility systems in robots involve a range of mechanisms, including wheels, tracks, legs, and even more advanced methods such as biomimetic systems inspired by animal locomotion. These systems are essential for robots to move through complex terrains, perform tasks, and interact with their surroundings.In recent years, significant advancements have been made in the mobility capabilities of robots, allowing them to adapt to diverse environments and perform a wide array of tasks. Innovations in this area include the development of agile and versatile robotic platforms, as well as the integration of intelligent control systems that enable robots to navigate autonomously. Additionally, the emergence of soft robotics has brought about new possibilities for creating more flexible and adaptable robotic locomotion systems, opening up new avenues for applications in areas such as search and rescue, exploration, and industrial automation.Overall, the study and development of mobility and locomotion in robotics continue to be a dynamic and rapidly evolving field, with ongoing research and innovation aimed at enhancing the agility, efficiency, and adaptability of robotic systems in diverse real-world scenarios.Human-Robot Interaction And InterfaceIn the realm of robotics, human-robot interaction and interface play a vital role in facilitating seamless communication and collaboration between humans and machines. These components encompass the design and implementation of interfaces, such as touchscreens, voice commands, and motion sensors, that enable users to interact with and control robots effectively. Human-robot interaction also delves into the development of intuitive and user-friendly interfaces that simplify the operation and programming of robots, thereby enhancing their usability across various industries.Furthermore, the interface design must prioritize safety and ergonomics, ensuring that humans can interact with robots without any risk of harm or discomfort. This involves implementing features such as obstacle detection, emergency stop buttons, and clear visual indicators to convey the robots status and intentions. Additionally, advances in artificial intelligence and machine learning have paved the way for more intuitive and adaptive human-robot interfaces, allowing robots to learn from human behavior and adapt their responses accordingly.Ultimately, the focus on human-robot interaction and interface represents a pivotal aspect of robotics, as it not only influences the user experience but also determines the efficiency, safety, and practicality of integrating robots into various settings, ranging from manufacturing floors to domestic environments.Future Trends In Robotic TechnologyAs the field of robotics continues to advance, several future trends are shaping the trajectory of robotic technology. One prominent trend is the integration of artificial intelligence (AI) to enhance robots cognitive abilities, enabling them to learn from their environments and adapt to dynamic situations in real-time. This includes the implementation of deep learning algorithms that can improve robots decision-making processes and problem-solving skills, ultimately making them more autonomous and versatile in their functions.Another trend on the horizon is the development of collaborative robots, also known as cobots, designed to work alongside humans in various industries. These robots are equipped with advanced sensors and safety features, allowing them to operate safely in proximity to human workers. This trend reflects the growing emphasis on human-robot collaboration and the potential for robots to augment human capabilities rather than replace them entirely. Furthermore, advancements in soft robotics and bio-inspired designs are paving the way for robots that can interact more safely and effectively with humans, as well as navigate complex and unstructured environments with greater agility and dexterity.As technology continues to evolve, it is likely that these future trends will further accelerate the capabilities and applications of robotic technology, revolutionizing industries and everyday human experiences alike.Final ThoughtsIn todays rapidly evolving technological landscape, robots have become indispensable in various industries, revolutionizing the way tasks are accomplished. With their essential components and features, robots are empowering businesses to streamline operations, enhance productivity, and drive innovation. As we continue to unveil the mechanics of modern technology, its evident that robots are poised to play an increasingly crucial role in shaping the future of automation and efficiency.As we embrace the intricate design and functionalities of robots, its imperative for organizations and individuals to harness their potential fully. By leveraging the dynamic capabilities of robots, we can create a more efficient, sustainable, and collaborative work environment. With ongoing advancements and integration of cutting-edge technologies, the era of robots promises to bring about transformative advancements in diverse fields, paving the way for an era marked by unprecedented efficiency and boundless possibilities.

What are the 3 main components of a robot. Robotic basic. What are the components of a robot. What are the main components of a robot. What are the 5 main components of a robot. What are the key components to every robot.