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An Exploration of Robotic System

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Abstract

Robots are not just machines, they are many steps ahead a typical machine. Robots like machines can perform different tough jobs easily but the advancement is that they can do it by their own. Once programmed robots can perform required tasks repeatedly in exactly the same way.Robotics is the branch of technology that deals with the design, construction, operation, and application of robots as well as computer systems for their control, sensory feedback, and information processing. Robotics is a key enabling industry for manufacturing. Without a strong robotics industry, Europe would quite simply not be able to maintain or expand its current level of manufacturing. To maintain a strong base in manufacturing, it is thus imperative to develop the next generation of industrial robots which can work in close proximity to humans, are easy to program and can also be adapted to the needs of small businesses (SMEs).

Keywords: EAP (Electro Active Polymer)

Introduction

The design of a given robotic system will often incorporate principles of Mechanical engineering, Electronic engineering and Computer science particularly Artificial intelligence. The study of biological systems often plays a key role in the Systems engineering of a project and also forms the field of Bionics. The mathematical expression of a biological system may give rise to control algorithms for example, or by observing how a process is handled by nature, for example the bifocal vision system, an analogous system may be formed using electronics.

Robotics has been often seen to mimic human behavior, and often manage tasks in a similar fashion. Today, robotics is a rapidly growing field, as technological advances continue, research, design, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots do jobs that are hazardous to people such as defusing bombs, mines and exploring shipwrecks.

History of Robotics

In 1927 the *Maschinenmensch* ("machine-human") gynoid humanoid robot (also called "Parody", "Futura", "Robotrix", or the "Maria impersonator") was the first depiction of a robot ever to appear on film was played by German actress Brigitte Helm in Fritz Lang's film Metropolis.

In 1942 the science fiction writer Isaac Asimov formulated his Three Laws of Robotics.

In 1948 Norbert Wiener formulated the principles of cybernetics, the basis of practical robotics.

Fully autonomous robots only appeared in the second half of the 20th century.

The first digitally operated and programmable robot, the Unimate, was installed in 1961 to lift hot pieces of metal from a die casting machine and stack them. Commercial and industrial robots are widespread today and used to perform jobs more cheaply, or more accurately and reliably, than humans. They are also employed in jobs which are too dirty, dangerous, or dull to be suitable for humans. Robots are widely used in manufacturing, assembly, packing and packaging, transport, earth and space exploration, surgery, weaponry, laboratory research, safety, and the mass production of consumer and industrial goods

Components

Power Source

At present mostly (lead-acid) batteries are used as a power source. Many different types of batteries can be used as a power source for robots. They range from lead acid batteries which are safe and have relatively long shelf lives but are rather heavy to silver cadmium batteries that are much smaller in volume and are currently much more

expensive. Designing a battery powered robot needs to take into account factors such as safety, cycle lifetime and weight. Generators, often some type of internal combustion engine, can also be used.

The design does come with the drawback of constantly having a cable connected to the robot, which can be difficult to manage Potential power sources could be:

- pneumatic (compressed gases)
- hydraulics (liquids)
- flywheel energy storage
- organic garbage (through anaerobic digestion)
- faeces (human, animal); may be interesting in a military context as faeces of small combat groups may be reused for the energy requirements of the robot assistant (see DEKA's project Slingshot Stirling engine on how the system would operate).

Actuation

Actuators are like the "muscles" of a robot, the parts which convert stored energy into movement. By far the most popular actuators are electric motors that spin a wheel or gear, and linear actuators that control industrial robots in factories. But there are some recent advances in alternative types of actuators, powered by electricity, chemicals, or compressed air.

Electric motors

The majority of robots use electric motors, often brushed and brushless DC motors in portable robots, or AC motors in industrial robots and CNC machines. These motors are often preferred in systems with lighter loads, and where the predominant form of motion is rotational.

Linear actuators

Various types of linear actuators move in and out instead of rotating, and often have quicker direction changes, particularly when very large forces are needed such as with industrial robotics. They are typically powered by compressed air (pneumatic actuator) or an oil (hydraulic actuator).

Series elastic actuators

A spring can be designed as part of the motor actuator, to allow improved force control. It has been used in various robots, particularly walking humanoid robots

Air muscles

Pneumatic artificial muscles, also known as air muscles, are special tubes that contract (typically up to 40%) when air is forced inside them. They have been used for some robot applications

Muscle wire

Muscle wire, also known as Shape Memory Alloy, Nitinol or Flexinol Wire, is a material that contracts slightly (typically under 5%) when electricity runs through it. They have been used for some small robot applications

Electroactive polymers

EAPs or EPAMs are a new plastic material that can contract substantially (up to 380% activation strain) from electricity, and have been used in facial muscles and arms of humanoid robots and to allow new robots to float, fly, swim or walk

Piezo motors

Recent alternatives to DC motors are piezo motors or ultrasonic motors. These work on a fundamentally different principle, whereby tiny piezoceramic elements, vibrating many thousands of times per second, cause linear or rotary motion. There are different mechanisms of operation; one type uses the vibration of the piezo elements to walk the motor in a circle or a straight line. Another type uses the piezo elements to cause a nut to vibrate and drive a screw. The advantages of these motors are nanometer resolution, speed, and available force for their size.These motors are already available commercially, and being used on some robots.

Elastic nanotubes

Elastic nanotubes are a promising artificial muscle technology in early-stage experimental development. The absence of defects in carbon nanotubes enables these filaments to deform elastically by several percent, with energy storage levels of perhaps 10 J/cm^3 for metal nanotubes. Human biceps could be replaced with an 8 mm diameter wire of this material. Such compact "muscle" might allow future robots to outrun and outjump humans

Sensing

Sensors allow robots to receive information about a certain measurement of the environment, or internal components. This is essential for robots to perform their tasks, and act upon any changes in the environment to calculate the appropriate response. They are used for various forms of measurements, to give the robots warnings about safety or malfunctions, and to provide real time information of the task it is performing.

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Touch

Current robotic and prosthetic hands receive far less tactile information than the human hand. Recent research has developed a tactile sensor array that mimics the mechanical properties and touch receptors of human fingertips.The sensor array is constructed as a rigid core surrounded by conductive fluid contained by an elastomeric skin. Electrodes are mounted on the surface of the rigid core and are connected to an impedance-measuring device within the core. When the artificial skin touches an object the fluid path around the electrodes is deformed, producing impedance changes that map the forces received from the object. The researchers expect that an important function of such artificial fingertips will be adjusting robotic grip on held objects.

Scientists from several European countries and Israel developed a prosthetic hand in 2009, called SmartHand, which functions like a real one—allowing patients to write with it, type on a keyboard, play piano and perform other fine movements. The prosthesis has sensors which enable the patient to sense real feeling in its fingertips

Benefits of Robotics

Many benefits of robots seem to be most noticeable in productivity, safety, and in saving time and money.

Productivity

- Robots produce more accurate and high quality work
- Robots rarely make mistakes and are more precise than human workers
- They can produce a greater quantity in a short amount of time
- They can work at a constant speed with no breaks, days off, or holiday time
- They can perform applications with more repeatability than humans

Safety

- Robots save workers from performing dangerous tasks
- They can work in hazardous conditions, such as poor lighting, toxic chemicals, or tight spaces
- They are capable of lifting heavy loads without injury or tiring
- Robots increase worker safety by preventing accidents since humans are not performing risky jobs

Savings

- Robots save time by being able to produce a greater magnitude of products
- They also reduce the amount of wasted material used due to their accuracy
- Robots save companies money in the long run with quick ROIs (return on investment), fewer worker injuries (reducing or eliminating worker's comp), and with using less materials.

Limitations of Robotics

There are some tasks for which human beings are better suited than robots. For example:

- Robots are not suited for creativity or innovation
- Robots are not capable of independent thinking
- Robots are not good at learning from their mistakes
- Robots are not as suitable for making complicated decisions
- Robots can't as readily adapt quickly to changes in the surroundings

Human beings are needed for these types of tasks, so there is hope that we will not become superfluous in a world dominated by robots at some point in the future, as projected by some science fiction authors.

Applications of Robots

Robots in Industry:

Modern industrial robots are true marvels of engineering.. Furthermore these robots can do that 24 hours a day for years on end with no failures whatsoever. Though they are reprogrammable, in many applications (particularly those in the auto industry) they are programmed once and then repeat that exact same task for years. Industrial robots are found in a variety of locations including the automobile and manufacturing industries. Robots cut and shape fabricated parts, assemble machinery and inspect manufactured parts. Some types of jobs robots do: load bricks, die cast, drill, fasten, forge, make glass, grind, heat treat, load/unload machines, machine parts, handle parts, measure, monitor radiation, run nuts, sort parts, clean parts, profile objects, perform quality control, rivet, sand blast, change tools and weld.

Robots in Medicine:

Robots are critical to the medical field where extreme precision and delicacy is necessary,

and the margin for error slim One of the main areas of robotics applications in medicine is in surgery. This is Because robots are able to perform major operations while only making small incisions, patients receive many benefits. Robots are used to perform heart surgery without opening patients chests. Another important area is in Prosthetics where Mechanical replacements for missing limbs and organs that can interact with the human organic system are a long-standing goal of the robotics community. Robotic devices can also provide assistance to people with severe restrictions on movement, in many cases allowing them at least some capability to move around or nearby their homes. On the other hand Rehabilitation Robots can provide exercise platforms to help restore limb function and can monitor the condition of patients undergoing rehabilitation from the effects of injuries, stroke or other brain or nerve damage.

Robots in Recreations and Sports:

Sports and recreations is one of the main areas of robotics industry. One of the main areas of robots in to make it look like humans . those robots are called humanoid robot which a robot with its overall appearance, based on that of the human body, allowing interaction with made-for-human tools or environments. examples of those are toys used for kids. Robots in sports are also another important issue like what is happening in soccer fields robots .where teams used to play real matches using just robots.

Robots in Space:

Applications outside the Earth's atmosphere are clearly a good fit for robots. It is dangerous for humans to get to space, to be in space and to return from space. Keeping robots operating reliably in space presents some unique challenges for engineers.. This is actually more of an opportunity than a challenge and leads to the possibility of some unique designs Robot in space can do all the work that man can not do there. It easy for manipulator to restore parts , to fix the space ship and to direct the wholes space shuttle.

Robots in Military and Security:

Some robots are used to investigate hazardous and dangerous environments. In these environments robots are used for firefighting, for entering into dangerous areas and for removing of injured persons in natural disasters. Another important applications of robots in security is for inspection and search for dangerous materials. In this robots will prevent and harms to humans operating it in case that something explodes during the inspection. Also robots are used during war for mine removal and entering into dangerous areas where robots will use guns as their manipulators.

Conclusion

The future of robots is mere speculation, but judging from developments in recent years, the continued advancements in technology are a foregone conclusion. Robots will likely continue to impact various aspects of our lives, and scientists and philosophers continue to debate the possibilities for the human race. As artificial intelligence continues to develop, there may be a point in which robots become superior to mankind. No matter the future holds, robots will have a place in it.

References

[1] *M.P.Groover, "Industrial Robotics – Technology, Programming and Applications",McGraw-Hill, 2001*

[2] *Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987*

[3] *Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992*

[4] *Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995.*

[5] *Gordon Mair, 'Industrial Robotics', Prentice Hall (U.K.) 198*

[6] *Wesley E Snyder R, 'Industrial Robots, Computer Interfacing and Control', Prentice Hall International Edition, 1988.*

[7] *Groover.M.P. Industrial Robotics, McGraw – Hill International edition, 1996.*

[8] *Saeed.B.Niku, 'Introduction to Robotics, Analysis, system, Applications', Pearson educations, 2002.*

[9] *M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001.*

[10] *Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987.*

[11] *Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995.*