International Journal of Engineering Research & Technology (IJERT)
NCETECE`14 Conference Proceedings
ISSN: 2278-0181

ROBOTICS SYSTEM

Manasvini Agrawal[1]
Nidhi Maru[2]
Priyanka Mangal[3]
[1,2] *Student,Deptt. Of Comp. Engg*
[3] *Lecturer,Deptt. Of Comp. Engg.*
Mandsaur Institute of Technology,Rewas Devra road, Mandsaur (M.P.)
agrawalmanasvini@gmail.com
nidhimaru1995@gmail.com
priyanka.mangal@mitmandsaur.info

Abstract- Robotics is the branch of technology that deals with the design, construction, operation and application of robots and computer systems for their control, sensory feedback and information processing. These technologies deal with automated machines that can take the place of humans, in hazardous or manufacturing processes, or simply just resemble humans. Many of today's robots are inspired by nature contributing to the field of bio-inspired robotics.

Key-words- Hydraulics, Actuation, Sensing etc.

I. INTRODUCTION

The concept in creation of machines that could operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. The modern concept began to be developed with the onset of the Industrial Revolution which allowed for the use of complex mechanics and the subsequent introduction of electricity. This made it possible to power machines with small compact motors. Today, it is now possible to envisage human sized robots with the capacity for near human thoughts and movement. The first uses of modern robots were in factories as industrial robots – simple fixed machines capable of manufacturing tasks which allowed production without the need for human assistance. Digitally controlled industrial robots and robots making use of artificial intelligence have been built since the 1960s.

Throughout history, 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 we continue to research, design, and build new robots that serve various practical purposes, whether domestically, commercially, or militarily. Many robots do jobs that are hazardous to people such as defusing bombs, exploring shipwrecks, and mines. Robotics is the branch of technology that deals with the design, construction, operation and application of robots and computer systems for their control, sensory feedback and information processing. These technologies deal with automated machines that can take the place of humans, in hazardous or manufacturing processes, or simply just resemble humans. Many of today's robots are inspired by nature contributing to the field of bio-inspired robotics.

II. HUMAN-ROBOT INTERACTION

If robots are to work effectively in homes and other non-industrial environments, the way they are instructed to perform their jobs and especially how they will be told to stop will be of critical importance. The people who interact with them may have little or no training in robotics, and so any interface will need to be extremely intuitive. Science fiction authors also typically assume that robots will eventually be capable of communicating with humans through speech, gestures, and facial expressions, rather than a command-line interface. Although speech would be the most natural way for the human to communicate, it is unnatural for the robot. It will probably be a long time before robots interact as naturally as the fictional C3PO.

III. DYNAMICS AND KINEMATICS

The study of motion can be divided into kinematics and dynamics. Direct kinematics refers to the calculation of end effectors position, orientation, velocity, and acceleration when the corresponding joint values are known. Inverse kinematics refers to the opposite case in which required joint values are calculated for given end effector values, as done in path planning. Some special aspects of kinematics include handling of redundancy (different possibilities of performing the same movement), collision avoidance, and singularity avoidance. Once all relevant positions, velocities, and accelerations have been calculated using kinematics, methods from the field of dynamics are used to study the effect of forces upon these movements. Direct dynamics refers to the calculation of accelerations in the robot once the applied forces are known. Direct dynamics is used in computer simulations of the robot. Inverse dynamics refers to the calculation of the actuator forces necessary to create a prescribed end effecter acceleration. This information can be used to improve the control algorithms of a robot.

IV. COMPONENTS

4.1 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. Potential power sources could be:

- Pneumatic(compressed gases)
- Hydraulics (liquids)
- Fly wheel energy control
- Organic garbage
- 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.

4.2 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.

4.3 Electric motors: - The vast 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.

4.4 Linear actuators;- Various types of linear actuators move in and out instead of by spinning, 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).

4.5 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.

4.6 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.

4.7 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.

4.8 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.

4.9 Piezo motors: - Recent alternatives to DC motors arepiezo 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.

4.10 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.

4.11 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.

4.12 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 finger tips. 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 Smart Hand, 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.

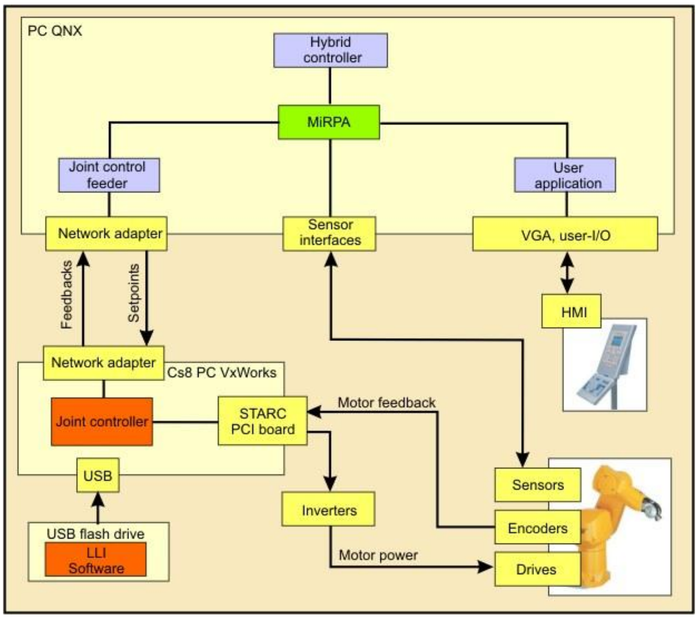
4.13 Vision: - Computer vision is the science and technology of machines that see. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences and views from cameras. In most practical computer vision applications, the computers are pre-programmed to solve a particular task, but methods based on learning are now becoming increasingly common.

Computer vision systems rely on image sensors which detect electromagnetic radiation which is typically in the form of either visible light or infra-red light. The sensors are designed using solid-state physics. The process by which light propagates and reflects off surfaces is explained using optics. Sophisticated image sensors even require quantum mechanics to provide a complete understanding of the image formation process. Robots can also be equipped with multiple vision sensors to be better able to compute the sense of depth in the environment. Like human eyes, robots' "eyes" must also be able to focus on a particular area of interest, and also adjust to variations in light intensities.

There is a subfield within computer vision where artificial systems are designed to mimic the processing and behavior of biological systems, at different levels of complexity. Also, some of the learning-based methods developed within computer vision have their background in biology.

V. ROBOTIC ARCHITECTURE

The term robot architecture is often used to refer to two related, but distinct, concepts. Architectural structure refers to how a system is divided into subsystems and how those subsystems interact. The structure of a robot system is often represented informally using traditional "boxes and arrows" diagrams or more formally using techniques such as UML [Jacobson et al 1998]. In contrast, architectural style refers to the computational concepts that underlie a given system. For instance, one robot system might use a publish-subscribe message passing style of communication, while another may use a more synchronous client-server approach. All robotic systems use some architectural structure and style. However, in many existing robot systems it is difficult to pin down precisely the architecture being used. In fact, a single robot system will often use several styles together. In part, this is because the system implementation may not have clean subsystem boundaries, blurring the architectural structure. Similarly, the architecture and the domain-specific implementation are often intimately tied together, blurring the architectural style(s). This is unfortunate, asa well-conceived, clean architecture can have significant advantages in the specification, execution, and validation of robot systems. In general, robot architectures facilitate development by providing beneficial constraints on the design and implementation of robotic systems, without being overly restrictive. For instance, separating behaviors into modular units helps to increase understandability and reusability, and can facilitate unit testing and validation.



VI. THE ART OF ROBOT ARCHITECTURES

Designing robot architecture is much more of an art than a science. The goal of an architecture is to make programming a robot easier, safer and more flexible. Thus, the decisions made by a developer of a robot architecture are influenced by their own prior experiences (e.g., what programming languages they are familiar with), their robot and its environment and the tasks that need to be performed. The choice of a robot architecture should not be taken lightly as it is the authors' experience that early architecture decisions often persist for years. Changing robot architectures is a difficult proposition and can set back progress while a great deal of code is re-implemented.

VII. CONCLUSION

Today we find most robots working for people in industries, factories, warehouses, and laboratories. Robots are useful in many ways. For instance, it boosts economy because businesses need to be efficient to keep up with the industry competition. Therefore, having robots helps business owners to be competitive, because robots can do jobs better and faster than humans can, e.g. robot can built, assemble a car. Medical Robotics is a highly challenging field; still it is in its embryonic state. There are several methods and security measures that ensue to see the field bloom to its full potential. Inclusion of Robots in surgery specifically is a matter that has lot many ideas to be considered. These range from the development, and international adoption, of safety standards the aim of task-specific, as opposed to general- purpose, robots the education of the medical community in the acceptance and integration of Robots. Yet robots cannot perform every job; today robots roles include assisting research and industry. Finally, as the technology improves, there will be new ways to use robots which will bring new hopes and new potentials.

REFERENCES

[1] INEEL website [online]. Available from: http://www.inel.gov/adaptiverobotics/humanoidrobotics/ Access 12 June 2005.

[2] Foerst Anne, (1999) Artificial sociability: from embodied AI toward new understandings of personhood, Technology in Society, 21, pp. 373–386. T209 Resource CD-ROM, Cyborg, part 2 – Robotics.

[3] ASIMO Honda [online]. Available from: http://world.honda.com/HDTV/ASIMO/ Access 11 June 2005.

[4] MIT website [online]. Available from: http://www.ai.mit.edu/projects/humanoid-robotics-group/ Access 11 June 2005

[5] Jones, A.C. (2002) 'Minds, matter and machines', T209 Resource CD-ROM, Cyborg, part 1 – Robotics.

[6] NASA website [online]. Available from: http://www-aig.jpl.nasa.gov/public/planning/dist-rovers/ Access 12 June 05.

[7] Bruce, I.S. (1998) 'Man Made', The Scotsman, December 1, Spectrum, p. UP4, T209 Resource CD-ROM, Cyborg, part 1- Bionics.