HUMANOID ROBOT

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Abstract : ***A dream of humanoid robot researchers is to develop a complete "human-like" (whatever that means) artificial agent both in terms of body and brain. We now have seen an increasing number of humanoid robots (such as Honda's ASIMO, Aldebaran's Nao and many others). These, however, display only a limited number of cognitive skills in terms of perception, learning and decision-making. On the other hand, brain research has begun to produce computational models such as LIDA. In this paper, we propose an intermediate approach for body-brain integration in a form of a scenario-based distributed system. Busy hospital Emergency Departments (ED) are concerned with shortening the waiting times of patients, with relieving overburdened triage team physicians, nurses and medics, and with reducing the number of mistakes. Here we propose a system of cognitive robots and a supervisor, dubbed the TriageBot System that would gather both logistical and medical information, as well as take diagnostic measurements, from an incoming patient for later use by the triage team. TriageBot would also give tentative, possible diagnoses to the triage nurse, along with recommendations for non-physician care Some of the robots in the TriageBot System would be humanoid in form, but it is not necessary that all of them take this form. Advances in humanoid robotic design, in sensor technology, and in cognitive control architectures make such a system feasible, at least in principle.***

Keywords: Healthcare Humanoids, Perception, Action and Cognition, Application.

Introduction:

Ever since the dawn of civilization, we as humans have been fascinated with machines and devices that can replicate aspects of biology, in particular of ourselves. Some are created for our entertainment, some to facilitate us in our daily lives, and historically speaking some were even created for imitating the power of gods (religious relics). The themes of these developments have gone in and out of trends in various forms, but the most fundamental issues were to explore points toward the eventuation of robotics as we know it today. We are on the verge of a new era of rapid transformations in both science and engineering, a transformation that brought together technological advancements in a fusion that shall accelerate both science and engineering. This new transformation brings together scientists working under a new direction of robotic research. The utility of robots holds great promise not only in industrial automation; more recently it has also been taken on by neuroscientists as a tool to aid in the discovery of mechanisms in the human brain. In particular, with the emergence of numerous advanced humanoid robots, unlike usual robotic systems, these are highly sophisticated humanlike machines equipped with humanlike sensory and motor capabilities. These robots are now among us, contributing to our scientific endeavors. Aiming at better assisting mankind has motivated engineers to look more closely at other scientific findings for the creation of innovative solutions that could better co-exist in our common society

What is a Humanoid Robot?

Humanoid may be defined as something that resembles or looks like a human being and has certain human characteristics like it has a similar shape as that of a human body. In general, a humanoid robot has a torso, a head, two arms, and two legs , and are categorized as male humanoids and female humanoids. The purpose of such robots may vary depending upon its biomechanics, functional capacity, production cost and complexity involved.

The Truth About Humanoid Robots:

With the faster rate of Technological advancements and emergence of International players in the technological market, there has been a boost in the field of Robotics. The increase in commercial investment, an emergence of international players, reduction in hardware cost and popularity of the existing robots are significant signs that indicate the field of Robotics is going through major transformation and development. In the present era of Technological development and advancements, Humanoid is being implemented in Robotics and these robots are called as "HUMANOID ROBOTS".

These robots vary depending upon the material they are made of and the design. Generally, humanoid robots come in three variations:

1) Small sized humanoids.
2) Medium sized humanoids.
3) Large sized Humanoids.

Classification of Robots:

Robots are categorized depending upon the circuits of the Robots and the variety of application it can perform.

1. Anatomy (body)
2. Control of movement
3. Kinematics/geometric structure
4. Energy source
5. Authority body
6. Industry/Non-industry
7. Technology level
8. Based on design
9. Application/jobs
10. By number of degree of freedom (gripper configuration)

What are Humanoid Robots made of ?

Though an extensive research is necessary before building a personal robot with anthropomorphic features that is accessible and appealing to the general user. To make the robot behave like a human being, sensors play a big role. The use of sensors in robotics has taken them to the new heights of creativity. Most importantly, the sensors have increased the performance of robots to a large extent. These sensors allow robots to perform various intellectual functions like a human being does making it unique. The present technology is able to offer many solutions to the different issues that generate regularly in the development of actuators and sensors, which are key factors in the achievement of the final goal in Robotics.

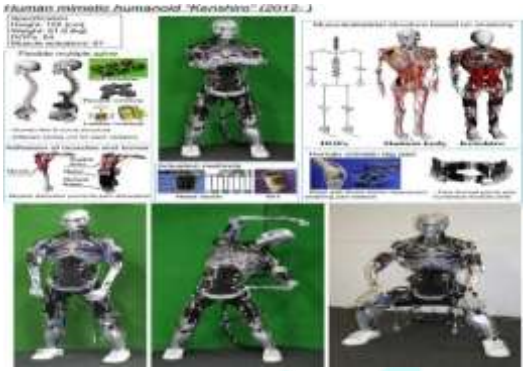

Fig.no-1

History of Humanoid robots:

The 1st robot was created in 15th century ie.1495 by Leonardo Divinci. It was a humanoid that could wave its arms, sit up, and move its head while opening and closing its jaw. It looked like armored knight made of plated steel.

Fig.no-2

The humanoid robot CB, we believe, is the first humanoid robotic system that is capable of full-body force-based (compliant) control. It has a similar range of motion, with a similar configuration (50 degrees of freedom), and has similar performance to that of humans. Additionally, its perceptual system attempts to mimic that of humans. This characteristic makes CB suitable as a research tool to investigate the neuroscience of information processing in the brain. This is because, we believe, a sophisticated system such as CB will impose the appropriate constraints by placing our exploration within the context of human interactions within human environments.

Fig.no-3

Different types of sensors used in the present day robots are:

1. Proprioceptive sensors: for sensing position, speed, and orientation.
2. Proximity sensor: to detect the presence of nearby objects.
3. Range sensor: to measure distances.
4. Tilt sensors: to measure inclination.
5. Accelerometers: to measure the acceleration.

Advanced Humanoid Robots:

Advanced humanoid robots are capable of multiple activities that are mere reflexes of a human being and do not require high intellectual efforts. These robots are fully automated as they can adapt to its surroundings and continue with its direction or command. Depending upon the size and weight, these robots have the capability of self-maintenance and an advanced feature of autonomous learning, thus they avoid harmful situations to people, property and themselves.

An advanced humanoid robot categorized as Android has human-like-behavior. It can talk like a human being in a computerized voice, run, jump or even climb stairs in a very similar way as a human being does. These humanoids perform a variety of jobs ranging from complex factory jobs to household solutions

Some of the advanced Humanoid Robots available in the market are:

DARwIn-OP (ROBOTICS OP) – it is created at Virginia Tech's Robotics and Mechanisms Laboratory (RoMeLa) in collaboration with Purdue University, University of Pennsylvania and Korean manufacturer ROBOTIS. This Humanoid can be used for household purposes, built with the main aim of education and research.

DARwIn Mini (ROBOTICS Mini) – DARwIn Mini is a very lightweight robot and it is much smaller humanoid robot kit that aims at makers and hobbyists. The 27cm (10.6 inch) tall robot is completely open source and the parts of this robot are 3D printable, which makes this an ideal and cost-effective development platform.

Fig.no-4

NAO Evolution – it is developed by French company Aldebaran Robotics which was released in 2014. This 58cm tall robot has 25 DOF and is packed with very distinctive kinds of sensors such as tactile sensors, sonar, and pressure, not to mention cameras and other standard equipment, being able to perform highly complex motions and tasks.

Fig.no-5

Pepper – it is a cute faced humanoid robot designed by Aldebaran in collaboration with Japanese communications giant SoftBank. The robot is designed in such a way which delivers high-level human interaction, therefore featuring few high-tech capabilities. The robot is equipped with a highly cloud-backed voice recognition engine that has the capacity to identify not only speech but also expressions, tonality and subtle variations in the human voice. The robot has the capability to absorb from its interactions, information about the environment and humans interacting with it are provided with the help of its 25 sensors and cameras.

Fig.no-6

Applications:

Currently, robots perform a number of different jobs in numerous fields and the amount of tasks delegated to robots is rising progressively. The best way to split robots into types is a partition by their application.

In science and engineering: In science: Building a humanlike machine and the reproduction of humanlike behaviors can in turn teach us more about how humans deal with the world, and the plausible mechanisms involved.

In engineering: Engineers can gain a great deal of understanding through the studies of biological systems, which can provide guiding principles for developing sophisticated and robust artificial systems.

1. Industrial robots – These robots bring into play in an industrialized manufacturing atmosphere. Typically these are articulated arms particularly created for applications like- material handling, painting, welding and others. If we evaluate merely by application then this sort of robots can also consist of some automatically guided automobiles and other robots.

Fig.no-7

2. Domestic or household robots – Robots which are used at home. This sort of robots consists of numerous different gears for example- robotic pool cleaners, robotic sweepers, robotic vacuum cleaners, robotic sewer cleaners and other robots that can perform different household tasks. Also, a number of scrutiny and tele-presence robots can also be considered as domestic robots if brought into play in that sort of environment.

Fig.no-8

3. Medical robots – Robots employed in medicine and medicinal institutes. First & foremost surgical treatment robots. Also, a number of robotic directed automobiles and perhaps lifting supporters.

Fig.no-9

4. Service robots – Robots that cannot be classed into any other types by practice. These could be various data collecting robots, robots prepared to exhibit technologies, robots employed for research, etc.One avenue of humanoid research has been considering humanoids as ideal service robots. Taking the view that much of our everyday environment has been specifically designed for the use of humans, these humanlike robots would ideally be suitable for performing daily chores usually done by humans. This type of robot has been considered to be the most suitable to assist mankind with daily activities.

Fig.no-10

5. Military robots – Robots brought into play in military & armed forces. This sort of robots consist of bomb discarding robots, various shipping robots, exploration drones. Often robots at the start produced for military and armed forces purposes can be employed in law enforcement, exploration and salvage and other associated fields.

Fig.no-11

6. Entertainment robots – These types of robots are employed for entertainment. This is an extremely wide-ranging category. It begins with model robots such as robosapien or the running photo frames and concludes with real heavy weights like articulated robot arms employed as movement simulators.

Fig no-12

7. Space robots – I would like to distinct out robots employed in space as a split apart type. This type of robots would consist of the robots employed on Canadarm that was brought into play in space Shuttles, the International Space Station, together with Mars explorers and other robots employed in space exploration & other activities.

Fig.no-13

8. Hobby and competition robots – Robots that is created by students. Sumo-bots, Line followers, robots prepared merely for learning, fun and robots prepared for contests.

Fig.no-14

9. Exploration :Robots can enter the environments that are injurious to human An illustration is observing the atmosphere within a volcano or investigating our deep marine life. NASA has utilized robotic probe for environmental study, ever since the early 60's.

Fig.no-15

10. Humanoid Robots as Research Tools:Although most robotic systems presented here are from research laboratories, many of them aim not just to build humanoid robots for the sake of constructing better machines. A number of these research laboratories are investigating issues beyond the engineering of systems; exploration is also underway in areas such as intelligent/cognition as well as basic science (thus, the research paradigm of "understanding through creating").

Fig.no-16

11. Social Interaction:Human-robot social interaction plays an essential role in extending the use of robots in daily life. Robots will be able to perform a lot of additional tasks if they possess the gift of social interaction. These robots can be used to help the aged, work with children having autism and patients finding physically or mentally difficult to perform tasks.Rather than mechanically performing tasks, if robots can respond intelligently, use proper body language, smile and react to a joke, accepting robots as part of our daily lives will also become quite easy.

Fig.no-17

12. Humanoid Robot in Neuroscience:The Advance Telecommunication Research Institute was the first to propose that a humanoid robot could actually contribute to neuroscience studies. In their work they demonstrated several aspects of humanlike learning, and were successful in applying these to humanoid robots. The humanoid robot, DB (dynamic brain), was specifically developed for this purpose. The success of this work set an important landmark in the application of scientific interchange between engineers and neuroscientists. ATR humanoid robot, DB (co-developed with SARCOS during the JST Kawato Dynamic Brain Project). (Courtesy of Stefan Schaal. With permission.)

Fig.no-18

Now, as you can observe that there are a number of examples that fit well into one or more of these types. For illustration, there can be a deep ocean discovery robot that can collect a number of precious information that can be employed for military or armed forces purpose. Robotics is a broad field and everyday there is a pioneering invention in the field. Robots were invented by the humans just for fun but by now they are used for assisting humans in various sectors. Human beings are better suitable for multifaceted, imaginative, adaptive jobs, and robots are good for dreary, recurring tasks, permitting human beings to do the harder thinking jobs, whereas a robot is employed for substituting humans for various recurring tasks or entertainment to make living more expedient.

Our Research Paradigm:

Such an approach will examine in depth various issues that go beyond the pure engineering of a robot and will require the integration of multiple disciplines in exploring and exploiting what has been learned from other fields such as philosophy, neuroscience, psychology, and physiology among others. It is foreseeable that this multidisciplinary integration approach will examine in depth:

- How do humans handle all different types of interaction with ease and in such a competent manner?
- How can such a rich system be built?
- What are the underlying mechanisms?
- What are the underlying processes and controls?
- How can we benefit from this approach?

At a further extreme both the Japanese and the Korean governments have decided to support projects related to humanoid robots that can facilitate society. A five-year project supported by the Ministry of Economy, Trade and Industry (METI) through the New Energy and Industrial Technology Development Organization (NEDO) of Japan, the Humanoid Robotics Project (HRP) was established to investigate possible "applications" for humanoid robots. They set out to examine five scenarios: (1) maintenance tasks of industrial plants, (2) tele driving of construction machines, (3) security service at home and office, (4) taking care of patients, and (5) cooperative works in the open air. The total robotic system was designed and integrated by Kawada Industries, Inc. together with the Humanoid Research Group of the National Institute of Advanced Industrial Science and Technology (AIST)

The NASA Johnson Space Center in the United States is developing a humanoid upper body robot for use in space. They have designed the humanoid robot, Robonaut. The primary objective of this system is to perform extravehicular activity (EVA). This sets the scene for future service robots in space.

CONCLUSION:

The information presented a research paradigm that brings a new direction in robotics that draws on neuroscience in the development of engineering systems, namely humanoid robotic systems.

A highly integrated humanoid robotic system, developed for studies of human like information processing in dealing with the real world was presented. The hardware and software architectures of the overall system were presented.