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Humanoid Robotics

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Abstract: An automaton may be a automaton with its body form designed to give the body. the look could also be for purposeful functions, like interacting with human tools and environments, for experimental functions, like the study of two-footed locomotion, or for alternative functions. In general, automaton robots have a body, a head, two arms, and 2 legs, though' some sorts of automaton robots could model solely a part of the body, for instance, from the waist up. Some automaton robots even have heads designed to duplicate human face expression like eyes and mouths. Androids area unit automaton robots designed to aesthetically gibe humans.

Humanoid robots square measure expected to exist and add a detailed relationship with people at large |individuals| personalities} within the everyday world and to serve the wants of physically unfit people. These robots should be ready to address the wide range of tasks and objects encountered in dynamic unstructured environments. robot robots for private use for old and disabled folks should be safe and simple to use. Therefore, robot robots would like a light-weight body, high flexibility, several forms of sensors and high intelligence. The victorious introduction of those robots into human environments can have confidence the event of human friendly part

Keywords: Humanoids, gait, Artificial intelligence, Research, Reinforcement learning

I. INTRODUCTION

Humanoid robots are now used as research tools in several scientific areas. Researchers study the human body structure and behaviour (biomechanics) to build humanoid robots. On the other side, the attempt to simulate the human body leads to a better understanding of it. Human cognition is a field of study which is focused on how humans learn from sensory information in order to acquire perceptual and motor skills. This knowledge is used to develop computational models of human behaviour and it has been improving over time. It has been suggested that very advanced robotics will facilitate the enhancement of ordinary humans. See transhumanism. Although the initial aim of humanoid research was to build better orthotic and prosthesis for human beings, knowledge has been transferred between both disciplines. A few examples are powered leg prosthesis for neuromuscular impaired, ankle-foot orthotic, biological realistic leg prosthesis and forearm prosthesis.

Besides the research, humanoid robots are being developed to perform human tasks like personal assistance, through which they should be able to assist the sick and elderly, and dirty or dangerous jobs. Humanoids are also suitable for some procedurally-based vocations, such as reception-desk administrators and automotive manufacturing line workers. In essence, since they can use tools and operate equipment and vehicles designed for the human form, humanoids could theoretically perform any task a human being can, so long as they have the proper software. However, the complexity of doing so is immense.

They are also becoming increasingly popular as entertainers. For example, Ursula, a female robot, sings, plays music, dances and speaks to her audiences at Universal Studios. Several Disney theme park shows utilize animatronics robots that look, move and speak much like human beings. Although these robots look realistic, they have no cognition or physical autonomy. Various humanoid robots and their possible applications in daily life are featured in an independent documentary film called Plug & Pray, which was released in 2010.

Humanoid robots, especially those with artificial intelligence algorithms, could be useful for future dangerous and/or distant space exploration missions, without having the need to turn back around again and return to Earth once the mission is completed

II. ARCHITECTURE

Figure 1. Architecture

III. HISTORY

The history of robots has its origins in the ancient world. During the industrial revolution, humans developed the structural engineering capability to control electricity so that machines could be powered with small motors. In the early 20th century, the notion of a humanoid machine was developed. The first uses of modern robots were in factories as industrial robots. These industrial robots were fixed machines capable of manufacturing tasks which allowed production with less human work. Digitally programmed industrial robots with artificial intelligence have been built since the 2000s

1900s

Starting in 1900, L. Frank Baum introduced contemporary technology into children's books in the Oz series. In The Wonderful Wizard of Oz (1900) Baum told the story of the cyborg Tin Woodman, a human woodcutter who had his limbs, head and body replaced by a tinsmith after his wicked axe had severed them. In Ozma of Oz (1907) Baum describes the copper clockwork man Tik-Tok, who needs to be continuously wound up and runs down at inopportune moments. In The Patchwork Girl of Oz (1913) a magician's wife stitches together a docile servant, but the Patchwork Girl is given an overdose of cleverness by the magician as substitute for intelligence.

Humanoid robotics is an important branch of biomimetic robotics and is not only associated with science and engineering disciplines but also deeply connected to social, legal, and ethical domains. Early attempts significantly underestimated the challenges associated; nevertheless, new theory and technologies have now come to fruition in realizing humanoid robots beside the classic Automata and Karakuri robots.

One important contribution to humanoid robotics was the zero-moment point (ZMP) stability theory introduced by Miomir Vukobratović in the 1960s. The first humanoid statically and later dynamically balanced robot, WABOT, by Ichiro Kato of Waseda University, Japan, was developed around the same time. For such achievements, these scientists must be recognized as pioneers of humanoid robotics. Since then, many scientists and engineers have been working on this topic. In 1997, Honda Motor revealed the Humanoid P2 at the 1997 IEEE International Conference on Intelligent Robots and Systems (IROS) in Grenoble, France. Subsequent development led to the ASIMO robot announced in 2000. The impact was felt beyond the robotics community: The general public was excited by its human-like android shape, natural gait walk, automatic slope balance, ability to climb up and down stairways, and human interactions. An increasing number of researchers have since been challenged to further develop humanoid robots.

After the Fukushima nuclear power plant disaster, the 2015 Defense Advanced Research Projects Agency (DARPA) Robotics Challenge demonstrated marked progresses in many ongoing humanoid projects. However, they still fell below our expectations (1). The humanoid robot clearly needs more research and development not only in mechanical design and control but also in perception and recognition capabilities. We are, after all, still at the beginning of a long journey of creating a humanoid robot that is intelligent and can act, reason, and interact like a human being in real-world scenarios.

While facing the challenges of designing and building a humanoid robot, it is important to provide extensive sensorimotor capabilities and to promote the discovery of new techniques and methods, which can be applied to more task-specific service robots or in other engineering fields. In the quest for humanoid robots, some laudable achievements include robots and machines with biped locomotion (2), learning capabilities (1), neuro-inspired control (1), predictive architectures (1), and many more bioinspired functions, making robots more effective in real-life settings.

Furthermore, humanoid robots can represent a research platform for studying not only robotics but also human beings. This is especially true for neuroscience, where human brain models can be implemented on humanoid robots. This can allow testing and validation of these models, in addition to providing humanoids with human-like sensorimotor functions. In fact, Mitsuo Kawato of ATR Japan proposed using humanoid robots to study human behavior at the beginning of this century (3). In Europe, this approach has been pursued in a number of EU-funded projects, which include the large-scale NEUROBOTICS project (4) across neuroscience and robotics and the RobotCub project, which led to the open iCub platform for the study of the development of cognitive capabilities (5). Today, the Human Brain Project consists of a dedicated neurorobotics platform for the implementation of brain models (6).

IV. APPLICATIONS OF HUMANOID ROBOTICS

Application of humanoid robots has been significantly used in healthcare and education domain. Majority of the study involved minors and senior citizens; moreover, economic feasibility was not tested in any study involved in this paper. The following section briefly discusses the influence of age, gender, and other experimental setups on the behavior of humans towards humanoid robots and their application in various domains.

A. Healthcare Humanoid Robot

Users and healthcare practitioner have appreciated the advantage of advanced surgical robots. However, our study highlights the application of humanoid robots and their roles in healthcare today. In addition to surgical robots, healthcare humanoid robots

have been successfully helping people in disease management, pain relief, pediatric healthcare assistant, and physical therapy. The role of healthcare robots can be broadly classified into the clinical and non-clinical application.

"Face Pain Scale-Revised" [3] approach was taken during vaccination of children in a clinical setup. The pain level of the children during the injection shot was measured through their facial expression and behavior such as crying or muscle tension. Children felt more pain during vaccination in the absence of a robot in the clinic [3].

Moreover, a study on the effect of a humanoid robot on anger, anxiety, and depression level has also been significant. To study the effect of a robot on anger and anxiety and difference between "social robot-assisted therapy" [2] and psychotherapy children who have cancer were given therapy session using a robot and a human psychotherapist.

B. Education Humanoid Robot

Use of computer and e-learning in the field of education have been performing well and have successfully increased the access to education worldwide. However, the recent trend in education domain is towards the application of humanoid robots. Humanoid robots are now becoming an essential component of education domain as these robots have the capability to reason and analyse situations logically to support human learning and are also better than computer agent and more engaging than the virtual agent . Comparison between a projected robot, a collocated robot, and an on-screen agent has been a relevant concern in the domain of education and e-learning.

C. Socially Assistive Robot

Social robots or socially assistive robots (SAR) are known as assistive robots, and their application is burgeoning especially among elderly people and hospitality industries. Social robot assists human beings in their daily life and replaces human activities at hospitality industries. At the domestic level, social robots have been doing well. Retired older adults or autistic patients mostly use the robots. These assistive robots act as a companion for both children and elderly individuals. Among children, social robots have been known for their ability to entertain and play games. Importantly, autistic children prefer to spend more time with a robot since robots are more predictive and less intimidating than human beings.

V. CONCLUSION

Humanoid robotics is always an interesting and challenging field in robotics. This paper reviewed some of the top humanoid robots where major breakthrough happened in the research over years. This paper presented the comparison of various technical features between different humanoid robots. Artificial Intelligence and Robotics are powerful combination that overcome the current drawbacks or finds new possibilities to improve the efficiency of robot's performance. With the increase in the open source society in this research field, developers all over the globe are coming up with best possible algorithms to solve and improve the performance of the humanoids. Still advanced research is going on to solve some of the problems mainly to improve the human-computer interaction, ability to handle any kind of terrain to travel and bring them cost effective.

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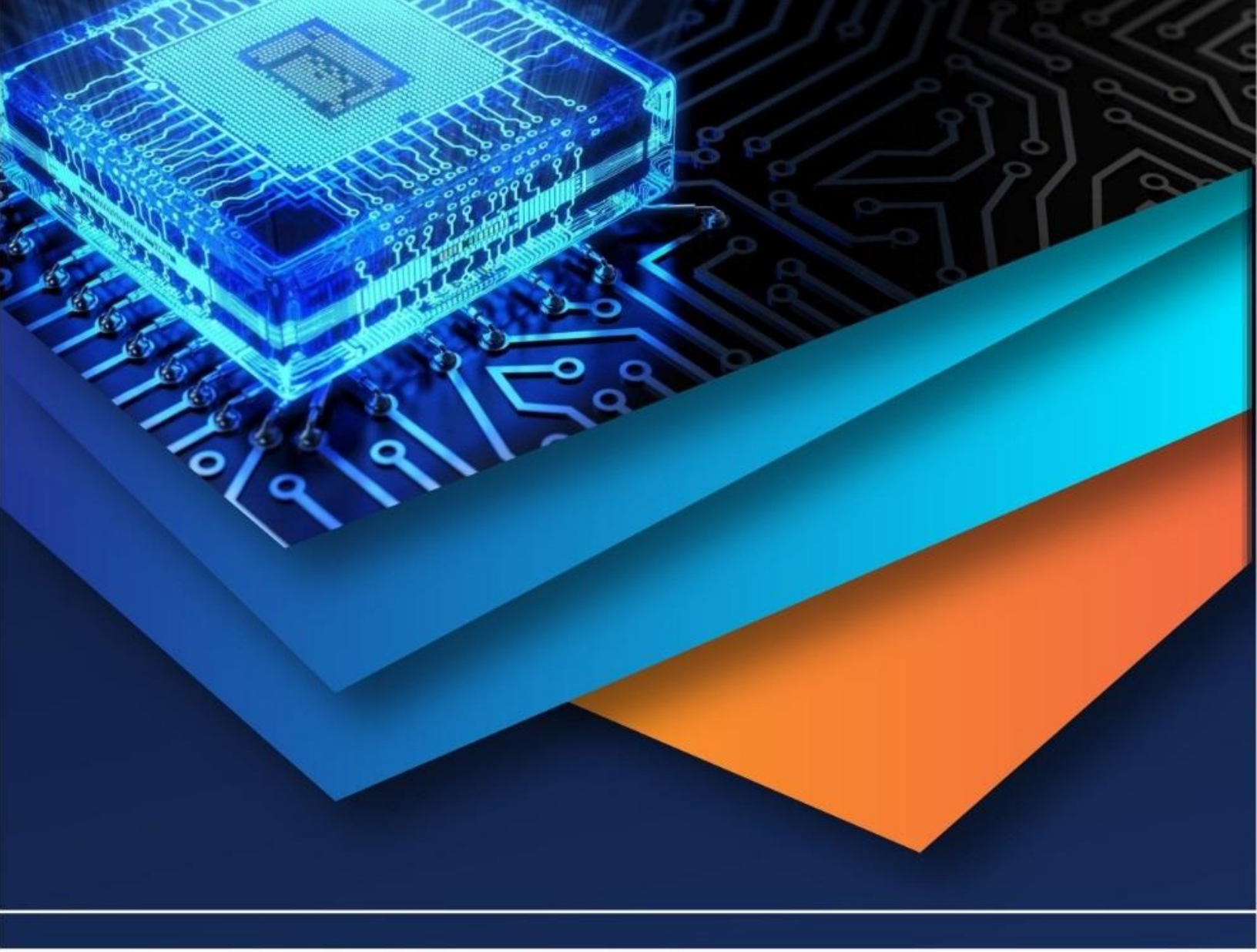

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