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Humanoid Robot

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Abstract – Application of humanoid robots has been common in the field of healthcare and education. It has been recurrently used to improve social behavior and mollify distress level among children with autism, cancer and cerebral palsy. This article discusses the same from a human factors' perspective. It shows how people of different age and gender have a different opinion towards the application and acceptance of humanoid robots. A human like autonomous robot which is capable to adapt itself with the changing of its environment and continue to reach its goal is considered as Humanoid Robot. These characteristics differs the Android from the other kind of robots. In recent years there has been much progress in the development of Humanoid and still there are a lot of scopes in this field. We present three humanoid robots aimed as platforms for research in robotics, and cognitive development in robotics systems. This paper presents the timeline of humanoid robots divided into 3 aspects such as its past, its present and its possible future .This paper showcases the need for the creation of the first few humanoid robots to the present ones to the ones that are yet to be created.

Key words : Humanoid robot, history of humanoid, medical treatment using , future of humanoid , evolution of humanoid Robot , education , human Behavior

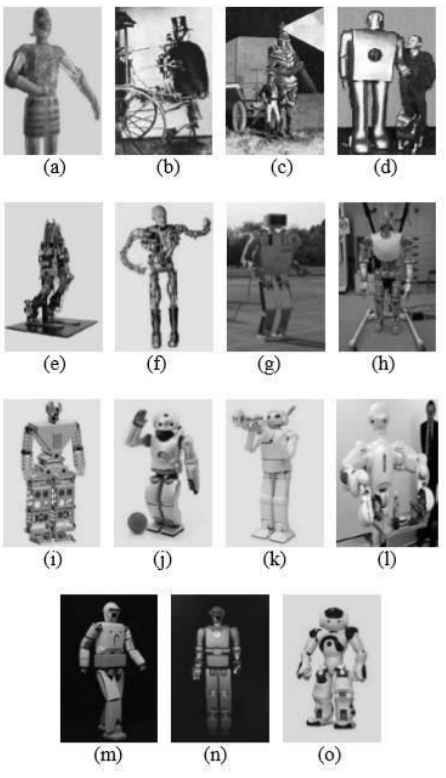
1.0 INTRODUCTION

Humanoid robots have been assisting humankind in various capacities. They have been broadly used in the field of Healthcare, Education, and Entertainment. A humanoid robot is a robot that not only resembles the human's physical attributes, especially one head, a torso, and two arms, but also can communicate with humans, take orders from its user, and perform limited activities. Most humanoid robots are equipped with sensors, actuators, cameras, and speakers.

Nowadays robots become very powerful elements in industry because of its capability to perform many different tasks and operations precisely. More over it does not need the common safety and comfort like human. It is the single greatest attempt to produce an artificial, sentient being. In the recent years manufacturers are making various types of humanoid robots which are more attainable to the general public. A computer being among us to help us out in ways better than an expected individual can is more than enough reason for the necessity of humanoid robots. They look like us, they communicate like us, they walk like us; all of these simple actions that humans are born with are nearly perfected to be duplicated by humanoid robots. As simple as the name suggests they are derivatives if human nature. The past, where how it all started out and the growth of it from literal and fictional state to a physical state. The present; where it showcases the current life of humanoid robots and the future; where it's most likely to be.

2.0 EVOLUTION OF HUMANOID ROBOT PLATFORM

2.1 Early research on Humanoid system



Some bipedal android platform from ancient time to present time. (a) First humanoid by Leonardo in 1495, (b) Steam Man in 1865, (c) Electric man in 1885, (d) ELEKTRO in 1938, (e) BIPER-4 in 1984, (f) Tron-Xm developed in Australia in 1997, (g) H6 humanoid from Tokyo University in 2000, (h) Robot JACK in September 2000, (i) GuRoo in 2002, (j) QRIO from SONY on September 19, 2003, (k) Partnar Robot by Toyota Motor Company in 2004, (l) TwendyOne in November 27, 2007 from Wasida University, (m) REEM-A, chess player robot by UAE in 2007, (n) REEM-B by UAE and (o) NAO, in French 2008.

2.2 Robot Platforms

Leonardo de Vinci who is considered as the first man, have drawn a humanoid mechanism in 1495. It was designed to sit up, wave arms, move head while opening and closing its jaw. The 18th century can be considered as the fertile period in the development of many autonomous which were able to reproduce some human movements. In 1773, Pierre and Henry Louis invented the first automation which was able to write. The mechanical trumpeter was created by Fridrich Kaufmann in 1810.

In this paper we briefly introduce three humanoid robot prototypes.

The goal is to make the robot strong and fast enough to be able to walk with normal human walking speed.

Figure 1: 'elvis' (left) and 'priscilla' (right).

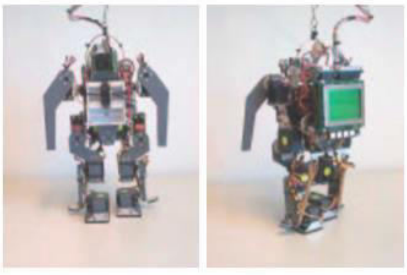


Figure 2: Front and back view of 'elvina' robot.

The 'elvis' robot is a scale model of a full-size humanoid with a height of about 70cm, built with 42 standard servo motors giving a high degree of freedom in legs, arms and hands. Microphones, cameras and touch sensors guide the robot.

'elvina' is a simplified, scaled model of a full-size humanoid with body dimensions that mirrors the dimensions of a human. The 'elvina' humanoid is a fully autonomous robot with onboard power supply and computer, however many experiments are performed with external power supply. It is 28cm tall and has a total of 14 degrees of freedom.

2.3 Japanese contribution in the development of humanoid system

Professor Kato's robotic team of Waseda University in Japan developed a whole family of Waseda Legged (WL) robots during 20th century. The fundamental function of bipedal locomotion was applied on the artificial lower-limb WL-1 which was constructed on 1967. WL-3 was created on 1969 having electro hydraulic servo actuators. Master-slave method based control mechanism was constructed and it was able to manage human like movement in swing and stance phase. Automatic biped walking and the ability to change direction of walking were experimented and made possible using WL-5 in 1972 where a mini-computer was used as its main controller. WL-5 was experimented using the lower limbs of the WABOT-1 having laterally bendable body through which it could move its center of gravity on a frontal plane. Artificial Muscle made of rubber was introduced in 1969 which was used as actuator in WAP-1. For WAP-2 the powerful pouch-type artificial muscles were used and automatic posture control was obtained by implanting pressure sensors under the soles.

2.4 Research on humanoid system in France

With the aiming to establish walking and running gait, the RABBIT project was started in 1998 with CNRS Grenoble, the Frence bipedal robot community. The system had a few DOF and each of the gearboxes of the motors was capable to produce a maximum torque of 150 Nm which was necessary for running gaits. The LIRIS Laboratory at the University of Versailles made an experimental anthropomorphic biped named ROBIAN in 2004 [8]. It had a three-dimensional kinematic architecture with 16 DOF motorized freedom. The 1.30m high robot weighs was 29kg and its foot was made up of an articulated forefoot along a transversal axis moved with a compliant link. The mechanism of the trunk having three mobile mass were used to transfer weight in three dimensions.

3.0 KEY POINTS

• The Social connectivity of individual influences their perspective towards the use of a humanoid robot. Lonely individuals, especially autistic children and older adults prefer an assistive humanoid robot.

• The appearance of the robot influences user acceptance and trust. Users irrespective of their age, gender, social and health status preferred robots with human-like appearance.

• Application of humanoid robot to treat autism among children has been useful.

• Trust on a humanoid robot depends on the criticality of the situation a user finds herself or himself. Trust factor increases with a decrease in the confidence of a user in any quantitative decision-making situation.

• Humanoid robot in the education domain has been effective in increasing student participation.

4.0 FUTURE OF ANDROIDS

In the next two decades robots will be used as the replacement of humans in most the manufacturing and service jobs. Economic development will be primarily determined by the advancement of robotics. Japan's current strength in this field says that they may become the economic leader in the near future. Microsoft is currently working to stabilize the fragmented robotics market with its new software, Microsoft Robotics Studio. Walking smoothly is not easy for a robot, especially when the ground is bumpy. Researchers at Japan's Waseda University have developed a pair of four foottall robotic legs that can move efficiently across uneven terrain. The Biped Walking Robot uses foot like sensors to measure the forces between its base and the floor, maintaining on-the-fly balance based on the weight of its load. In near future humanoids will exhibit emotion, forge relationships, make decisions, and develop as they learn through interaction with the environment. Robots that can incrementally acquire new knowledge from autonomous interactions with the environment are

Table -1 Life of Humanoid Robots

S No	Humanoid robot development	Year	Reference
1	Hero of Alexandria described a machine to automatically pour wine for party guests	AD 50	Hero of Alexandria; Bennet Woodcroft (trans.) (1851). Temple Doors opened by Fire on an Altar. Pneumatics of Hero of Alexandria. London: Taylor Walton and Maberly (online edition from University of Rochester, Rochester, NY). Retrieved on 2008-04-23.
2	Leonardo da Vinci designs a humanoid automaton, known as Leonardo's robot.	1495	'MegaGiant Robotics'. megagiant.com.
3	Pierre Jacquet-Droz and his son Henri-Louis created the Draughtsman, the Musicienne and the Writer, a figure of a boy that could write messages up to 40 characters long	1774	'Best robot 2009'. www.gadgetrivia.com.
4	Elektro is the robot built by the Westinghouse Electric Corporation in its Mansfield, Ohio	1937	The Return of Electro, Jack Weeks, New Scientis
5	Wabot-1. It was able to walk, to communicate with a person and to measure distances and directions to the objects using external receptors, artificial ears and eyes, and an artificial mouth	1973	'Historical Android Projects'. androidworld.com.
6	WHL-11 is a biped robot capable of static walking.	1985	'Historical Android Projects'. androidworld.com.
7	Saika, a light-weight, human-size and low-cost humanoid robot, was developed at Tokyo University	1996	'Historical Android Projects'. androidworld.com.
8	Sony unveils small humanoid entertainment robots, dubbed Sony Dream Robot	2001	'Sony Global - Product & Technology Milestones-Robot'. sony.net.
9	Actroid, a robot with realistic silicone 'skin' developed by Osaka University in conjunction with Kokoro Company Ltd	2003	kokoro-dreams.co.jp
10	Nao is a small open source programmable humanoid robot developed by Aldebaran Robotics, in France	2006	Aldebaran Robotics
11	Justin, a humanoid robot developed by the German Aerospace Center	2008	'DLR Portal - Der Mensch im Mittelpunkt - DLR präsentiert auf der AUTOMATICA ein neues Chirurgie-System'
12	NASA and General Motors revealed Robonaut 2, a very advanced humanoid robot.	2010	'Say Hello to Robonaut2, NASA's Android Space Explorer of the Future'. Popular Science.
13	second generation Honda Asimo Robot	2011	'Latest Version of ASIMO Makes North American Debut in New York'. Honda. 17 April 2014.
14	Manav – humanoid robot developed in the laboratory of A-SET Training and Research Institutes	2014	Menezes, Bery 'Meet Manav, India's first 3D-printed humanoid robot'. www.livemint.com
15	New version of Atlas ,it is a bipedal humanoid robot developed by the American robotics company Boston Dynamics, with funding and oversight from the U.S DARPA	2016	'Modest Debut of Atlas May Foreshadow Age of 'Robo Sapiens''. New York Times.

the main target to accomplish. Humanoid Robotics also offers a unique research tool for understanding the human brain and body.

5.0 ANTHROPOMORPHIC PRINCIPLE

The anthropomorphic principle behind humanoids might be a stronger motivation factor then conventionally assumed. Consider for example the phenomenon of human left-handedness. Left-handed persons have been shown to have a shorter expected life length than right-handed persons. The standard explanation for the higher mortality rate is a higher accident frequency and the assumed explanation for this deviation is due to the fact that the world is built for right-handed people (Gazzaniga, 1999). If such a minute deviation in behavior could cause accident frequencies measurable in as statistically significant mortality biases, we could expect considerable difficulties for a robot working in a human environment. The differences between human and robot will always be bigger there, than the difference between a left-handed and right-handed person. We aim at exploring and evaluating the consequences of a strong anthropomorphic principle where humanoids are built with very close correspondence with humans in terms of size, weight, geometry and motion capabilities. We have therefore devised a full-sized autonomous humanoid1 robot that is built around an accurate model of a human skeleton -the 'priscilla' robot.

6.0 Embodiment and Adaptivity

From a methodological and developmental standpoint are the project guided by more than the anthropomorphic principle. Even though we have simulators for the 'priscilla' robot we strongly believe in the embodiment principle and we try to make most of our experiments on the full-size autonomous 'priscilla' robot. However, the over-all efficiency of our humanoid project has turned out to increase when using several smaller size prototypes. A third guiding principle is the need for adaptivity when dealing with such a complex object as a humanoid in such a complex environment as everyday human life. We are furthermore using evolutionary algorithms and more specifically genetic programming as the adaptation method. Genetic programming is an efficient method for breeding symbolic structures such as computer programs and behavior definitions

7.0 CONCLUSION

The 3 aspects of time are shown in this journal. The creation of the idea of humanoid robot from the past to its present state to its future is being understood and showcased in this journal. The different aspects of humanoid robots and its application and its future possibilities are shown in this journal. The journal starts with the current status of the idea of humanoid robots. The existing technological developments in the field are shown.

our three humanoid robots 'priscilla', 'elvis' and 'elvina' and some of the underlying conceptual principles. The basis for our research is the anthropomorphic principles where humanoids are built with very close correspondence with humans in terms of size, weight, geometry and motion capabilities.

The users have appreciated the role of humanoid robots in the field of healthcare and education. Contrastingly, people's attitude towards social or assistive robots varies significantly. Children and elderly users prefer robots and have less resistance towards the application of humanoid robots than that of middle-aged users. Trust and acceptance of humanoid robots were affected by its appearance, gaze, and functionality.

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