**HUMANOID ROBOTICS**

 Ancy Joy Anithamol Benny

Department Of ECE Department Of ECE

Viswvajyothi College Of Viswajyothi College Of

Engineering and Technology Engineering And Technology

Vazakkulam Vazhakkulam

***Abstract****-*The field of Humanoid Robotics is widely recognized as the current challenge for robotics research .The humanoid research is an approach to understand and realize the complex real world interactions between a robot, an environment, and a human. The humanoid robotics motivates social interactions such as gesture communication or co-operative tasks in the same context as the physical dynamics. This is essential for three-term interaction, which aims at fusing physical and social interaction at fundamental levels. This paper represents the basics of robotics in the context of artificial intelligence and provides solution in future trend in robotics. It describes the very basics of robotics like sensors and actuators, gives an overview on robotic history and introduces some basic problems encountered in modern robotics. It describes possible solutions to those problems without going deeply into theory.

1. **INTRODUCTION**

A humanoid robot or an anthropomorphic robot is a [robot](http://en.wikipedia.org/wiki/Robot) with its overall appearance, based on that of the [human body](http://en.wikipedia.org/wiki/Human_body), allowing interaction with made-for-human tools or environments. 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 will accomplish tasks by means their designers did not explicitly implement, and will adapt to unanticipated circumstances of unstructured environments. Already, humanoid robots can autonomously perform task decomposition necessary to carry out high-level, complex commands given through gesture and speech. Humanoids can adapt and orchestrate existing capabilities as well as create new behaviors using a variety of machine learning techniques. In fact, some researchers claim to have implemented a first stab at the "seed" which will allow robot intelligence to develop indefinitely. As they adapt to their own, unique experiences with the world, we will look out upon a population where no two humanoids are exactly alike.

1. **A BRIEF HISTORY OF ROBOTS**

Humanity has long been fascinated by the possibility of automata (from the Greek "automatos," acting of itself). In the second century B.C., Hero of Alexander constructed statues, doors and small mechanical animals that could be animated by water, air and steam pressure. By the eighteenth century, elaborate mechanical dolls were able to write short phrases, play musical instruments, and perform other simple, life-like acts. Today, robots are no longer mere curiosities, but have become an indispensable pillar of global industry. We have millions of factory automation robots carrying out complex tasks around the clock. From clockwork, gear-filled devices, we have arrived at lethal instruments of war such as the unmanned military vehicles vividly demonstrated to the world during the 1991 liberation of Kuwait. With the rise of the computer, people immediately began to envision the potential for encoding human intelligence into textual programs, but soon discovered that static programs and rule-based logic cannot capture the true essence of human intelligence. Early attempts to create artificial intelligence produced information-processing machines that operated on high-level human concepts, but had difficulty relating those concepts to actions and perceptions in the external world. Estranged from perception and action, such intelligence derived meaning only as an extension of the human creator or user. In 1973, the construction of a human-like robot was started at the Waseda University in Tokyo under the direction of the late Ichiro Kato. He and his group developed WABOT-1, the first full-scale anthropomorphic robot in the world. It consisted of a limb-control system, a vision system and a conversation system. WABOT-1 was able to communicate with a person in Japanese and to measure distances and directions to the objects using external receptors, artificial ears and eyes, and an artificial mouth. The WABOT-1 walked with its lower limbs and was able to grip and transport objects with touch-sensitive hands. At the time, it was estimated that the WABOT-1 had the mental faculty of a one-and-half-year-old child. In 1985, Kato and his research group at Waseda University built WASUBOT, a humanoid musician (WAseda SUmitomo roBOT), developed with Sumitomo Electric Industry Ltd. WASUBOT could read a musical score and play a repertoire of 16 tunes on a keyboard instrument. Since these early successes, the Japanese electronics and automotive industries have played a key role in the emergence of humanoids by creating robots of humanoids by developing robots capable of walking over uneven terrain, kicking a soccer ball, climbing stairs and performing dexterous tasks such as using a screwdriver and juggling. At the present time, we have full-scale humanoid robots that roughly emulate the physical dynamics and mechanical dexterity of the human body.



Figur1 .WABOT - 1 Humanoid Project at Waseda University



Figure 2.WABOT-2 an anthropomorphic robot musician

1. **WHAT IS HUMANOID ROBOT**

Humanoid Robotics includes a rich diversity of projects where perception, processing and action are embodied in a recognizably anthropomorphic form in order to emulate some subset of the physical, cognitive and social dimensions of the human body and experience. Rather than distinguish humanoids by their physical construction, we choose to identify several complementary research areas that, thus far, have stood out as distinct emphases. Eventually, a fully-fledged humanoid robot will incorporate work from each of the areas below.

*A.Perception*

This area includes computer vision as well as a great variety of other sensing modalities including taste, smell, sonar, IR, haptic feedback, tactile sensors, and range of motion sensors. It also includes implementation of unconscious physiological mechanisms such as the vestibulo-ocular reflex, which allows humans to track visual areas of interest while moving. Lastly, this area includes the attentional, sensor fusion and perceptual categorization mechanisms which roboticists implement to filter stimulation and coordinate sensing.

#### *B.Human-robot interaction*

This area includes the study of human factors related to the tasking and control of humanoid robots. How will we communicate efficiently, accurately, and conveniently with humanoids? Another concern is that many humanoids are, at least for now, large and heavy. How can we insure the safety of humans who interact with them? Much work in this area is focused on coding or training mechanisms that allow robots to pick up visual cues such as gestures and facial expressions that guide interaction. Lastly, this area considers the ways in which humanoids can be profitably and safely integrated into everyday life.

#### *C.Legged locomotion*

For humanoids to exploit the way in which we have structured our environment, they will need to have legs. They must be able to walk up stairs and steep inclines and over rough, uneven terrain. The problem is that walking is not simply a forwards-backwards mechanical movement of the legs, but a full-body balancing act that must occur faster than real-time. The best approaches look closely at the dynamics of the human body for insight.

#### *D.Arm control and dexterous manipulation*

Around the world, researchers are working on dexterous tasks including catching balls, juggling, chopping vegetables, performing telesurgery, and pouring coffee. From a mechanical point of view, robot arms have come a long way, even in the last year or so. Once large and heavy with noisy, awkward hydraulics, some humanoids now have sleek, compliant limbs with high strength to weight ratios. While mechanical innovation will and should continue, the real hard problem is how to move from brittle, hard-coded dexterity toward adaptive control where graceful degradation can be realized. The humanoid body functions as a whole and consequently, small errors in even one joint can drastically degrade the performance of the whole body.

### IV. CURRENT RESEARCH PROJECTS

 Humanoid Research has already begun to accelerate.This section highlights endeavors in legged locomotion, arm control and dexterous manipulation, robot-human interaction, service robots, learning and adaptive behavior, perception, and anthropopathic (emotive) robots. These categories certainly should and do overlap. Robust arm control is, of course, impossible without perception. Legged locomotion for rough terrain usually requires a panoply of machine-learning techniques. One of the most encouraging things for the world of Humanoid Robotics is the increased collaboration and community between these various projects and research areas.

*A.Legged Locomotion*

In 1980, Waseda University developed WL-9DR, the world's first robot to exhibit quasi-dynamic walking. Five years later, Waseda University's Humanoid Research Laboratory teamed with Hitachi Ltd. to develop the WHL-11 (Waseda Hitachi Leg-11) biped, walking robot. Using the earlier WL series robot as a model, they added an onboard computer and a hydraulic pump that allowed the robot to walk on a flat surface at 13 seconds a step. In one exhibition, WHL-11 walked over 64km. The drawback to such approaches was that WHL-11 had no ability to climb up inclines or over obstacles. Since then, much work has gone into control systems that can adjust gaits, and balance the body in real time to allow more versatile walking.

Legged locomotion is much easier to accomplish (and much safer to develop and test) on smaller humanoids. The SDR-4X was recently developed by Sony as a domestic robot capable of handling uneven surfaces and stairs on the fly. While other approaches have demonstrated hard-coded walking behavior, the Sony project attempted to create a truly useful robot that can sense depth and distance of objects sufficiently well to be able to walk over obstacles and adjust its gaits on the fly to cope with changing surface heights. The project is also remarkable for the flexibility of the robot, which allows it to dance and contort itself much more freely than most humanoid systems.



Figure 3.WHL - 11 Humanoid Project at Waseda University

****

Figure 4.The SDR-4X uses vision to adapt its walking behavior to cope with stairs and other features typical of a home.

*B.Robot-Human Interaction*

An ambitious project at MIT is based on the premise that humanlike intelligence requires humanoid interactions with the world. These researchers are developing a robot they call Cog as a set of sensors and actuators that tries to approximate the sensory and motor dynamics of a human body. Cog is equipped with a sophisticated visual system capable of saccades, smooth pursuit, vergence, and coordinating head and eyes through modeling of the human vestibulo-ocular reflex. Cog responds not only to visual stimulation, but also to sounds and to the ways people move Cog's body parts. By exploiting its ability to interact with humans, Cog can learn a diverse array of behaviors including everything from playing with a slinky to using a hammer. Eventually, Cog will have the ability to be tasked naturally and quickly by users who may not know beforehand what tasks the robot will need to accomplish. The user should be able to demonstrate actions and supply auditory and visual cues to help the robot correctly perceive the instructions.

**

Figure 5.The newest version of Cog, developed at MIT AI laboratory.

*C. Service & entertainment robots*

HARIS, a robotic arm and human interface, is designed to help disabled people move and fetch objects. With the human hand as a model, researchers created a robotic manipulation system capable of tasks such as picking up a coffee cup, grasping an egg, dialing a telephone call, and holding a coffee bottle.



Figure 6.Dexterous hand of HARIS, a robotic arm and human interface. National Center for Science Information Systems in Tokyo, Japan**.**

Humanoid robots are also surfacing in the entertainment industry. "Ursula" the Female Android is a remote-controlled full-size robot that walks, talks, dances, plays music and more. "Ursula" makes for incredible entertainment and an effective communicator of special messages than can captivate any crowd.

**V. CONCLUSION**

The world's population of real humans continues to steadily grow. One might ask why we would want to make a machine that looks, thinks and emotes like a human when we have plenty of humans already, many of whom do not have jobs or good places to live. It is important to re-emphasize that humanoids cannot and will not ever replace humans. Computers and humans are good at fundamentally different things. Calculators did not replace mathematicians. They did change drastically the way mathematics was taught. For example, the ability to mentally multiply large numbers, although impressive, is no longer a highly valued human capability. Calculators have not stolen from us part of what it means to be human, but rather, free our minds for more worthy efforts. As humanoids change the contours of our workforce, economy and society, they will not encroach on our sovereignty, but rather enable us to explore and further realize the very aspects of our nature we hold most dear.

Yet, no matter how quickly technological progress seems to unfold, foresight and imagination will always play key roles in driving societal change. We cannot shirk responsibility by calling the future inevitable. It is difficult to direct a snowball as it careens down the slope; thus, it is now - when there are only a handful of functional humanoids around the world - that we must decide the direction in which to push. Humanoids are the products of our own minds and hands. Neither we, nor our creations, stand outside the natural world, but rather are an integral part of its unfolding. We have designed humanoids to model and extend aspects of ourselves and, if we fear them, it is because we fear ourselves.

*REFERENCES*

[1].Robotics And Intelligence System https://inlportal.inl.gov

[2].Humanoid Robot, <http://en.wikipedia.org>

[3].Internationl Journal Of Humanoid Robotics, <http://www.worldscinet.com>

[4].Humanoid Robots, <http://www.engineersgarage.com>

[5].Reinforcement –Lear ning –Humanoid Robotics, <http://web.cecs.pdx.edu>

[6].Grasping And Manipulation In Humanoid Robots, <http://www.frc.ri.cmu.edu>

[7].Humanoid Robotics, [http://www.seminarsonly.com](http://www.seminarsonly.com/)

### [8]. [How To Make *a* Humanoid Robot Open a Door - IEEE Spectrum](http://www.google.co.in/url?sa=t&rct=j&q=how%20to%20make%20humanoid%20robots&source=web&cd=1&ved=0CCwQFjAA&url=http%3A%2F%2Fspectrum.ieee.org%2Fautomaton%2Frobotics%2Frobotics-software%2Fhow-to-make-a-humanoid-robot-open-a-door&ei=89RkT5adDcLorQekyYG9Bw&usg=AFQjCNHn10Uk3_1oFPec9dxvnY7jn8JqVg&cad=rja), http://spectrum.ieee.org