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Analysis of the Industrial Impact by the Application of Humanoid Robots in the Various Fields

By

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Abstract

The use of robots in the industry is not new as with time use of robots in the industry is implemented in various industrial approaches. Thus, the focus of the study is to know the application of robots, the importance of robots, and their impact on developing industrialization. Humanoid robots are human-like robots used for various operations that humans are unable to perform. The analysis made by different experts on humanoid robots in human life and their impact on society as well as industries. There are various studies made on the design and development of robots by different researchers, authorities, and companies to develop human-like robots. The analysis states that humanoid robots are useful to humans if it is designed properly to replace humans in various operations to reduce labor costs and investments. Further study in humanoid robots will help in developing robots for multifunctional operations so that less human labor is required in any work with low cost.

Keywords: Artificial Intelligence (AI), Humanoid, Industry, Robots, Technology.

Introduction

A machine, more precisely one that can be programmed by a computer and is capable of executing a complicated sequence of actions on its own, is referred to as a robot. Robots are capable of doing these things because they are machines. Robots can be controlled either from inside the robot itself or from the outside via a control mechanism. Although some robots are built to resemble humans, most robots were task-performing devices that place a greater focus on bare utility than on expressive aesthetics. A robot that resembles a person's body in shape is called a humanoid robot. The design could be intended for experimental aims, such as the study of bipedal movement, functional objectives, such as interface with human equipment and environments, or other purposes [1]–[4].

Humanoid robots typically have a head, torso, two legs, and two arms, and a torso; however, there are humanoid robots that just duplicate a portion of the human shape, such as the upper body. Some humanoid robots have been designed with accurate copies of human lips and eyes mounted on their heads. Intelligent machines are humanoid robots, which are designed to mimic people as closely as possible. The concept of humanoid robots can be traced back to several different civilizations from all over the world. Greek mythology and different works of Chinese religious and philosophical writing from the fourth century BCE also include several accounts of humanoid automata, some of which are among the oldest known examples of such accounts. Later, humanoid automata were built as physical prototypes in France, Italy, Japan, and the Middle East. Hephaestus, the Greek god of metalworkers, is credited in several stories

with creating a variety of humanoid automata. Hephaestus is credited in Homer's Iliad with the creation of golden handmaidens and endowing them with human voices so it could be used as instruments or as aids to speech. In a different Greek tale, Hephaestus is said to have fashioned the enormous bronze robot Talos as a defense mechanism for Crete to use against invaders [5]–[7].

A humanoid robot was described in depth in Lie Yukou's Taoist philosophical work Liezi from the third century BCE. The fifth ruler of the Chinese King Mu, Zhou Dynasty, commissioned an existence, human-like robot from an engineer by the name of Yan Shi. Leather and wood made up the majority of the robot's construction. It was able to move every part of its body, sing, and walk. Ismail al-Jazari, a Muslim engineer, created several humanoid automata during the 13th century. He built a robot waitress that would serve customers by emerging through an automated door and pouring beverages from a liquid reservoir. To replenish a basin of water after it had been drained, he developed another automaton that was used for washing hands. Leonardo da Vinci imagined a sophisticated mechanical robot in the 1400s that could stand up, sit down, and autonomously move its arms while wearing a coat of armor. A mechanism of pulleys, as well as cables, was used to control the complete robot [8], [9].

The Japanese created karakuri puppets, humanoid automata, during the 17th and 19th centuries. These doll-like puppets were employed for amusement at religious festivals, in households, and theatres. Butai karakuri, or theatrical karakuri, are puppets used in plays. Zashiki kurakuri, a type of little karakuri puppet used in houses, was set up on tables and used to serve beverages, dance, and beat drums. Dashi karakuri, or religious puppets, were utilized at religious festivals to act out stories and legends. Jacques de Vaucanson, a French inventor, was responsible for the creation of the extraordinary humanoid automaton known as The Flute Player in the 18th century. This wooden robot, which is about the size of a person, can play a variety of tunes on the flute [10].

It was made out of a network of pipes, bellows, weights, as well as other mechanical parts that mimicked the flute player's muscles. Today, humanoid robots are employed in a variety of scientific fields [16]-[41] as research instruments. [16], [17]. To create humanoid robots, scientists examine the biomechanics of the human body and behavior. On the other hand, trying to imitate the human body helps to comprehend it better. [18] Human cognition is a branch of research that focuses on how people pick up perceptual and motor abilities through learning from sensory data. The computer models of human behavior that are created using this information have gotten better over time. [19] - [23].

1. Literature Review

Christou et al. (2020) [11] discussed that businesses in the tourism industry that use robots face the risk of being seen as being non-anthropocentric. This points to the possibility that anthropomorphism might be employed in the business; nevertheless, it should not take the place of anthropocentrism. The study demonstrates the concerns that site users have about the determinism of technology. There was already some controversy about the employment of robots in the tourist industry before the coronavirus outbreak rekindled it. The study's focus is on how tourists feel about anthropomorphic robots and the use of robotics in general. In-depth qualitative research was conducted on the issue of tourists' perceptions of the use of anthropomorphic robots in tourism, and 78 interviews with tourists were archived for analysis. According to the collected statistics, humanoid robots get the highest approval rating among

guests. Humanoid robots might provide a new dimension to the travel experience. However, several respondents expressed frustration, sadness, and remorse at the thought of robots being used in a human-centered industry.

Kayembe et al. (2019) [12] suggested that the study aims to analyze the challenges and opportunities confronting the educational system in the era of the Fourth Industrial Revolution (4IR). Based on interviews and desk research, the study analyzes the South African education market. Discreet research methods, such as documentary analysis and conceptual analysis, were used to examine reputable sources to conceive and contextualize the 4IR and education. The study's findings show that South Africa's educational system faces a variety of challenges as it attempts to adapt to the Fourth Industrial Revolution (4IR). Graduates are not adequately prepared for their role in the 4IR due to a lack of resources, facilities, and expertise. These findings also suggest that government spending on physical and human, technical, and financial capability is essential for getting schools ready for the 4IR.

Luo et al. (2018) [13] evaluated that the rapid development of information technology and the requirements of economic society have led to the advent of the golden age, which has been ushered in by artificial intelligence. The use of technology that makes use of artificial intelligence in the field of accounting is an inescapable trend that would lead to considerable change and development within the accounting industry. This article investigates the use of artificial intelligence in the accounting industry, investigates the impact of artificial intelligence (AI) on the development of the accounting industry, and provides applicable answers to the problems that are plaguing the sector at present.

Montobbio et al. (2022) [14] suggested that the study looks at whether or not labor-saving strategies are mentioned explicitly in robotic patents. It examines the innovative people and economic factors behind robotics technology, and it pinpoints the fields of study most at risk of being disrupted by time- and energy-saving innovations. It uses the ORBIS company-level dataset in conjunction with state-of-the-art natural language processing and probabilistic topic modeling techniques to analyze all patent applications filed with the USPTO between 2009 and 2018. Based on the statistics, it seems that producers and users of robots are among the patent holders for labor-saving technologies. Since then, the supply chain as a whole has had access to labor-saving robotic patents. This study shows that labor-saving technologies represent a risk to roles that need interpersonal skills and critical thinking.

Chevalier et al. (2020) [15] evaluated that the paper takes a look at the many methods that have been used to investigate joint attention, and it highlights the benefits of new methodological techniques that make use of cutting-edge technological developments, such as humanoid robots, to study social cognition. After reviewing the conventional methods that have been used to study joint attention processes using carefully manipulated screen-based stimuli, researchers describe the emerging viewpoints that urge for more organic and interactive forms of experimentation. While modern techniques can improve ecological validity, it might be challenging to manage experiments involving realistic social interaction procedures. Researchers propose that using humanoid robots in interactive protocols is an excellent way to investigate the mechanisms of shared attention. Humanoid robots provide better experimental control and ecological validity when interacting with humans in naturalistic situations. New diagnostic and treatment options for children with autism spectrum disorder are made possible by its clinical uses. Healthcare applications and human-robot interaction as a whole are highlighted as needing further research. The summary of the literature review is shown below in table 1:

Table 1. *summary of literature review*

Author	Methodology	Outcomes
Christou et al. (2020) [11]	In-depth qualitative research was conducted on the issue of tourists' perceptions of the use of anthropomorphic robots in tourism, and 78 interviews with tourists were archived for analysis.	According to the collected data, visitors have a strong preference for humanoid robots over all other sorts of robots.
Kayembe et al. (2019) [12]	Based on interviews and desk research	The results also highlight the importance of public expenditures on infrastructure and human, technological, and financial competence in preparing schools for the 4IR.
Luo et al. (2018) [13]	AI	A key part of the accounting industry's reform and innovation process should include elevating the use of AI.
Montobbio et al. (2022) [14]	AI, robotics technology	The research demonstrates that jobs requiring social intelligence and analytical reasoning are in danger from the rise of labor-saving technology.
Chevalier et al. (2020) [15]	AI	Humanoid robots' ability to interact with people in realistic settings improves experimental control and ecological validity. Its therapeutic applications provide new avenues for identifying and treating youngsters with an autism spectrum disorder.

2. Results and Discussion

Humanoids are a class of professional service robots that are supposed to move and interact like humans. As is the case with other intelligent devices, their primary focus is on the creation of value via the automation of operations in a way that both boosts productivity and lowers associated costs. The development of humanoid robots is a relatively recent step forward in the field of professional service robots. Even though they have been conceptualized for a considerable amount of time, they are beginning to show promise in a variety of applications. The market for humanoid robots is anticipated to expand significantly. In 2023, the market for humanoid robots is anticipated to be worth $3.9 billion, expanding at an astounding 52.1percent compound annual growth rate (CAGR) from 2017 to 2023. Bipedal robots are anticipated to have the quickest CAGR of any form of humanoid robot throughout the anticipated timeframe.

The rapidly evolving abilities of such robots and their feasibility in an ever-widening variety of applications are mostly to blame for the market for humanoid robots fast expansion. Humanoid robots do an inspection, maintenance, and emergency response at power plants to free up human employees from potentially dangerous and difficult activities. Additionally, they are ready to carry out the typical astronaut responsibilities in space. Companionship for the old and sick, guiding, customer service, and maybe even the cultivation of human organs for transplantation are among the many other possibilities. Humanoid robots have the potential to automate everything from life-threatening rescues to tender care for those in need. The applications for these robots are continuously growing, and as fundamental technology

advances, the market will follow as shown in Figure 1.

Figure 1. *Represents the Humanoid Robot Sophia Developed by Hanson Technology [Source: Wikipedia]*

Experts and academics have been investigating what ethical principles can govern robot conduct as they grow more sophisticated and smarter, as well as whether or not robots would be able to assert any sort of social, cultural, ethical, or legal rights . According to one research team, a robot brain might exist by the year 2019. By 2050, according to some, robot intelligence will advance. The sophistication of robotic behavior has increased recently. A 2010 new documentary titled Plug & Pray examines the societal consequences of sentient robots.

From basic robotic helpers like the Handy 1 to semi-autonomous robots like FRIEND, which can help the elderly and disabled in daily duties, robots used in building automation have evolved through time . In many nations, notably Japan, the population is aging, which increases the number of old people who need care but a proportional decline in the number of young people who can provide it. The finest caregivers are humans, but robots are rapidly replacing them in situations when they are not accessible.

A semi-autonomous robot named FRIEND was created to assist elderly and handicapped individuals with daily tasks including food preparation and service. Patients with significant paralysis (caused by strokes, for example), muscular illnesses, or paraplegia can use FRIEND to execute chores without the assistance of therapists or medical personnel. The mining sector today faces a variety of issues, such as a lack of skilled labor, a need to increase efficiency in the face of diminishing ore grades, and the need to meet environmental goals.

The risky nature of mining, especially underground mining, has led to a significant rise in the popularity of automated, semi-autonomous, teleported robots in recent years. Many automakers provide self-driving trains, trucks, and loaders that can load, transport, and unload material on a mining site without the need for human interaction. Rio Tinto, one of the biggest mining companies in the world, has increased the size of its independent truck navy, making it the largest in the world with 150 automated Komatsu trucks working in Western Australia. Similar to how BHP announced the addition of 21 automated Atlas Copco drill, the biggest fleet of autonomous drill in the world.

There are currently autonomous drilling, long wall, and rock-breaking devices available. An Atlas Copco Rig Automation System can autonomously carry out a drill plan on the drilling rig, positioning the rig using GPS, setting it up, and drilling to predetermined depths. The Transmit Rock logic technology can similarly autonomously create a route to put a rock breaker at a chosen location. The safety and effectiveness of mining operations are significantly improved by these solutions. The SWORDS robot, utilized in ground-based warfare right now, is an example of a military robot. It is capable of using a variety of weaponry, and the idea of granting it considerable autonomy on the battlefield has been brought up.

Unmanned combat air vehicles (UCAV), an improved version of UAVs, are capable of carrying out several tasks, including fighting. UCAVs are being developed, like the BAE Organizations Mantis, which would be able to fly themselves , choose their target and path, and make the majority of choices independently. The British-made BAE Taranis UCAV can travel across continents without the need for a pilot and has innovative ways to evade detection. In 2011, flight experiments are anticipated to start. The AAAI has thoroughly investigated this matter, and its chairman has ordered a study to investigate this problem.

Some have argued that "Friendly AI" must be developed, which refers to an endeavor to create AI inherently amiable and compassionate in addition to the advancements now being made in the field. According to reports, several such laws already exist, including robot-heavy nations like South Korea and Japan starting to enact rules mandating robots to be outfitted with safety mechanisms and maybe even sets of "laws" like Asimov's Three Laws in Robots . The Robot Industry Policy Council of the Japanese government published a formal report in 2009. In a paper titled "Robot Legal Studies," Chinese officials and experts propose a set of ethical principles and a new set of legal regulations.

General-purpose autonomous robots are capable of performing a wide range of tasks on their own. Typical capabilities of general-purpose autonomous robots include the ability to move autonomously in familiar environments, manage their recharging requirements, interact with automated doors and elevators, and carry out other simple tasks. General-purpose robots, like computers, can benefit from networking, software, and peripherals. It could be able to see people or things, have conversations, be a companion, keep an eye on its surroundings, react to warnings, go on supply runs, and more.

General-purpose robots can carry out several tasks at once or switch between different responsibilities during the day. These robots are known as humanoid robots because they replicate human behavior and sometimes even look like people. Since no humanoid robot has been able to successfully explore a room, it has not been in before, humanoid robot technology is currently at a very early stage. Thus, despite their sophisticated actions in their well-known surroundings, humanoid robots are extremely constrained.

1. Conclusion

Inside a regulated setting, preprogrammed robots carry out routines that are quite straightforward. An example of a preprogrammed robot would be the robotic arm that is used on an assembly line for automobiles. It is the purpose of the arm to do a task for a longer period, quicker, and with more success than a human could, such as welding a door or installing a specific component into the engine. Humanoid robots are devices that behave or look like humans and are designed to emulate human behavior. Typically, these robots can do activities that people are capable of, and in certain cases, they are created to imitate humans, replete with human traits and attitudes. Figure 1 shows the Hanson Robotics Sophia robot, and Figure 2 shows the Boston Dynamics Atlas robot, both of which are great examples of humanoid robots. Robots that perform autonomously do so without the need for human oversight. These robots often do work in public places without the supervision of a human being. They are highly distinctive in that they utilize decision-making systems to choose the best course of action based on given data and purpose and then use sensors to see the environment around them. The Roomba vacuum cleaner is one instance of a mobile robots that utilizes sensors to move around a house.

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