A SURVEY ON ARTIFICIAL INTELLIGENT ROBOTICS

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Abstract: The world is rapidly moving towards the automation. When the word automation is used then our mind turns towards the Artificial Intelligent and Robots, but AI without Robots and Robots without AI does not fulfill the requirement of automation, then after merging these technologies Artificially Intelligent Robots were developed. This article gives the overall view of Artificially Intelligent Robotics. It especially focused on functionality and components of Artificially Intelligent Robotics and how it changes the life of humankind. In today's society, it's used is limited, but as the world moving towards automation in next few year it is used in almost every area.

Index Terms **- Artificial Intelligent, Robotics, Robots, Machine learning, Computer vision, Artificial neural networks**

I. INTRODUCTION

Anything that could give rise to smarter than human intelligence in the form of Artificial Intelligence, brain computer interfaces, or neuroscience-based human intelligence enhancement wins hands down beyond contest as doing the most to change the world. Nothing else is even within the same league."- EliezerYudkowsky. [1] "People ar fascinated by robots as a result of they are machines that may mimic life." - Colin Angle. [2] Artificial Intelligence and Robotics both have a long history and both are originated from the common root and in the same period (,,50), thus they are related to each other and very famous topic for interaction and scientific discussion. Initially, there was no clear distinction between the two disciplines. The reason is that the belief of creating an advance machine automatically leads to robots and robotics. This article focuses on the functionality and purpose of Artificially Intelligence Robots in various areas like medical, military, space research, exploration, industries, entertainment, rescue and several other areas and how it changes the human's life. When we imagine the future, we might think the use of a humanoid robot that explore the space, performing dangerous military operations, performing critical surgery, rescue missions. Being a soldier it is very tough and dangerous task to fight against with enemies but what if we assign these dangerous tasks to humanoid robots who have their own intelligent system and capable of taking decisions on its own, we only lose money and resources when something went wrong, but we save our humans life, but in all we can say that these robots can play prominent role either in the protection of mankind or in the destruction. In case of space exploration it is very costly and risky to send humans into deep space, so in this situation, robots are more effective and reliable.

II. HISTORY

Robots form the substitute agents acting in exceedingly real-world surroundings. Robots are aimed at manipulating the objects by perceiving, picking, moving, modifying the physical properties of an object, destroying it, or to have an effect thereby freeing manpower from doing repetitive functions without getting bored, distracted, or exhausted. It is a machine which is equipped with sensors, processors, computer control system, human interface system and accompanied with AI act upon the real world environment. "John McCarthy" is the father of AI. The history of robots is not a present-day concept, in the year 1898 an American researcher, Nikola Tesla demonstrated a wireless boat which works on radio wave and controlled by a remote controller. It was a great invention that changed our vision in robotics. The AI is the concept which provides the ability to machine to extract, analyze the environment and then react accordingly. The first general purpose robot was developed from approximately 1966 through 1972 named "Shakey the robot" developed at the Artificial Intelligent Centre of Stanford Research Institute. After that many new robots were developed and the first artificial personal robot was developed by US Startup Robotbase which is 4-foot tall uses deep neural networks to assist in day-to-day tasks.

III. ARTIFICIAL INTELLIGENT

Artificial Intelligence is the combination of two words, in which the word Intelligence means the ability to calculate complex algorithms, solve reasoning, perceive relationships and analogies, learn from experience, store retrieve, analyze and manipulate information of the surroundings, problems solving ability, comprehend complex ideas, use natural language fluently to communicate, classify, generalize, and adopt new situations, and when these ability and functioning is implemented artificially as in the form of software then it is termed as Artificial Intelligence. Some of the modern AI"s are Google Assistant, Cortana, Siri, and Mycroft.
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3.1 Tasks of AI

Mundane tasks: Mundane tasks are Perception, Common Sense, Reasoning, Natural Language Processing, and Planning. Perception is done using Computer Vision, Speech and voice, whereas Natural Language processing is done using Understanding, Language Generation, and Language Translation.

Formal tasks: Formal tasks are Verification, Solving Mathematics, Theorem Proving and Playing Games.

Expert tasks: Expert tasks are Engineering, Scientific Analysis, Financial Analysis and Medical Diagnosis.

IV. ROBOTICS

Robotics is a one of an important branch of AI and without AI it is impossible to imagine about intelligent robots. Robot composed of Electrical Engineering, Mechanical Engineering, and Computer Science for designing, construction, and application of robots.

There are three Laws of Robotics according to Asimov"s short story "Runaround":

1. A robot might not injure an individual's being or, through inaction, enable an individual's being to come back to damage.

2. A robot should conform the orders given it by groups of people except wherever such orders would conflict to the primary Law.

3. A robot should defend its own existence as long intrinsically protection doesn't conflict with the primary or Second Laws.
In later stories, Asimov's robots blame for the govt. of entire planets and human civilizations. Then he added a fourth, or zeroth law, to precede the others. A robot might not damage humanity, or, by inaction, permit humanity to return to damage.

4.1 Aspects of Robotics

Mechanical Construction: It means, form, or shape provided to robots to perform the desired task for which it is built and designed.
Electrical Components: These components supply power to the machinery and control the functionality of robots. Electrical components consist of wires, chipsets, microphone, sensors, and cameras. Computer Program: It loaded with some level of a computer program, by which robots decide when, what and how to perform the operation.

4.2 Components of robots

Power Supply: To work the robot well, it is necessary that power is supplied to every electrical component of a robot and it is achieved by batteries, solar power, hydraulic, or pneumatic power sources.

Actuators: It is necessary to convert energy into a movement for performing some useful task and the component used for this is actuators.

Electric Motors (AC / DC): For rotational movement, motors are one of the most useful components.

Pneumatic Air Muscles: They contract virtually forty per cent once the air is sucked in them.

Muscle Wires: They contract by 5% when an electric current is passed through them.

Piezo Motors and Ultrasonic Motors: It is used mostly in industrial robots.

Sensors: Various sensors are used in the robots to get the real-time information from the environment. Sensors like vision sensors used to visualize the depth in the surrounding task environment whereas a tactile sensor senses the touch of human fingertips.

V. ARTIFICIALLY INTELLIGENT ROBOTICS

Robots that are controlled by Artificial Intelligence programs are the Artificially Intelligent Robots. AI Robot is the composition or can say bridge between robotics and AI. ALL robots are not artificially intelligent, as industrial robots could only be programmed to perform only a few repetitive series of movements, and repetitive movements do not require artificial intelligence. Non-intelligent robots perform very limited functions. AI algorithms are required to perform a more complex task using robots. There are the certain main components

that make a simple robot to Artificially Intelligent robot Computer Vision, Machine Learning, Artificial Neural Networks, Human-Robot Interface.

5.1 Computer Vision

To analyze the surrounding environment robots used the technology of AI is called as computer vision. It plays an important role in the domains of safety, health, entertainment, access and security. Computer vision automatically extracts information from a single image or an array of images or in other forms such as video sequence, then after analyses and comprehended useful information from the images or video sequences. This process involves the development of algorithms to accomplish automatic visual comprehension.

5.1.1 Hardware of Computer Vision System

This involves:
1. Power supply
2. Image acquisition device such as camera
3. A processor
4. Software
5. A display device for monitoring the system
6. Accessories such as camera stands, cables, and connectors

5.1.2 Tasks of Computer Vision

OCR: Optical Character Reader is used to convert scanned documents into editable and readable text. OCR accompanies a scanner, which scans the character.

Face Detection: In present days many high-end and Smartphone cameras come with this feature, which enables the device to read the face and take the picture of that perfect expression. Now it is also used as a password and let a user access the device or apps on correct match.

Object Recognition: Basically object recognition is a technology which is used to recognize the object. They are installed in supermarkets, Smartphone cameras, cars and many other devices.

Estimating Position: Estimating position is a software which is used estimating the position of an object with respect to the camera it is used in almost all the fields like space science to target the position where to land spaceship, in medical to position tumors in the human body for operation.

5.2 Machine Learning

Machine learning is the branch of computer science which gives the ability to the system or machine to learn virtually from the real world without explicitly programmed. "Arthur Samuel", an American researcher coined the term "Machine Learning" in 1959 while he was working at IBM.
Machine learning is derived from the study of Pattern Recognition and Computational Learning Theory in AI, it is employed where designing and programming explicit algorithms is difficult or infeasible with desired performance. The main purpose of machine learning is to study and construction of algorithms that can learn and make a prediction on data. Now training steps are pursued ranging from machine learning approaches to genetic programming and neural networks.

5.2.1 Types of Machine Learning

Supervised learning: In supervised learning example inputs and their desired output is presented by the teacher and let the machine to learn a general rule that maps inputs and outputs.

Unsupervised learning: In unsupervised learning, leaving the learning algorithm on its own to find structure in its input. The goal is to let the algorithm in itself to discovering a hidden pattern in data or a means towards an end.

Reinforcement learning: In reinforcement learning let the computer interact and perform certain goal in the dynamic environment, and the program is provided feedback in terms of reward and punishment.

The best example of machine learning is the face detection and voice recognition. In face detection, the first system learns to detect face, it first learn what are parts a face consists of and what are their position and when any of the objects come in front of its image acquisition device like camera then it matches the position of the parts of the face like eyes, nose, lips and if all set good and at their position then it detects that it is a human face.

5.3 Artificial Neural networks

The idea of ANNs comes from the working of the human brain. The brain consists of 86 billion nerve cells called neurons and they are connected to other thousand cells by Axons and dendrites that accept the inputs from sensory organs, The input signals quickly travels in the neural networks from one neuron to another in the form of electrical impulses and then the neuron send the messages to another neuron to handle the issue. The human brain works fine only because of making the right connection. In case of a machine, silicon is used as neurons and wires as dendrites. AANs consist of nodes, which is same as neurons in human brains. The nodes are connected to each other by a link to interact each other. The node takes input and performs some operation and sends the output to another node for further operation or does not send forward. The output generated by a node is called as activation or node value. Each link has their weight, and thus by changing the weight value, ANNs are capable to learn that what happens when the weight value of the link is altered.

5.3.1 Types of ANNs

There are two types of ANN topologies – FeedForward and Feedback.

FeedForward ANN: This is unidirectional ANN that is the information flows only in one direction. The information is sent from one node to another but the sending node does not get any information from the receiver node, so there is no any feedback loop. It has fixed input and output and is used only for pattern generation or pattern recognition or pattern classification.

Feedback ANN: This ANN is two directional that is the information is sent from one to other and the receiver also sends the signal back, so there is a feedback loop between nodes and used in addressable memories.

VI. IMPLEMENTATION OF AI ROBOTICS

AI Robots are implemented in almost every area and have many applications in present days. It is mostly used in medical, space exploration, military, industries, rescue operation, entertainment to perform those tasks which are difficult for humans, risky and time-consuming. Google Self driving car which is the best example of AI robotics, its average speed is 25 mph and can be operated in any type of roads. It is connected with GPS to gets its rough location and point radar, lasers and camera used for monitor surrounding over 360 degrees; it consists of onboard system and software which helps it to navigate in the traffic very easily and accurately. It is more efficient and accurate than a human driver.

Fig 6.1 Google Self Driving Car (Source: motortrend.com)

Some of the areas where it is widely used are:

Space: Space is very vast and extremely dangerous, so it is more convenient to explore it with the help of robots rather human, but there exist many problems to operate robots remotely in distant places like Mars, Jupiter or any such place because it takes hours to travel the signal and processing, sometimes the robots have to respond quickly as the weather or condition changes at that places, so in that case AI robots are used which take care of themselves. Mixed-initiative Activity Plan Generator (MAPGEN), it is based on "EUROPA", and is an AI planning tool which supports the Deep space 1 mission, which is launched on Oct 24, 1998, and now it supports the Mars Exploration Mission.

Now, NASA improves MAPGEN software for another Mars mission, which lands on red planet next year.

Fig 6.2 Artistic image of Deep space 1 probe (Source: NASA)

SPIFe is another software which is tested that could help astronauts work independently in space. It enables the crews in spaceship more self-sufficient, using advanced planning software crews does not depend on people on earth for the plan. The human-robot team could inspect their vehicles and make repair unassisted.

Fig 6.3 Scientist testing the software that allows wireless communication

Humans do not have to dedicate continuous attention to the robot. (Source: NASA)

Medical: In medical robots are used in critical surgery operated by the surgeon, but recently many new autonomous robots are developed which is perfect and accurate than a surgeon. Smart Tissue Autonomous Robot (STAR), in recent experiments, STAR"s inventor cuts the flesh more precisely and accurately than expert surgeon do, and damage less surrounding flesh. This is not the first time the robot does surgery accurately before that in 2016 STAR sewed two segments of pig intestine with stitches more precisely than an expert surgeon.

Fig 6.4 STAR Surgical Robot (Source: pbs.org)

In September Singapore"sChangi General Hospital tested the self-driving wheelchair which is developed by the Singapore-MIT Alliance for Research and Technology or SMART. It has 6 wheels which lend the stability and make tight turn fit in normal doorframes. It successfully navigates the hospital hall, to navigate it make a map using data from three lidars and localization algorithm determines where it is, and another one is developed by Panasonic and Whill, Inc which is tested at Haneda Airport, Tokyo.

Fig 6.5 Wheelchair (Source: Panasonic)

Industries: Today"s world is in the mid of 4th industrial revolution, driven by information and automation. AI and machine-learning are shifting the way we interact with data and also changing how we will manufacture the modern world.

AI and Automation is next step in the advancement of industries. Robots serve in almost every role from designing to shipping the product.

Recently in Robotics and Artificial Intelligence Lab at the University of Rochester, trained a Baxter assembly robot to understand and respond to natural language commandsWhen the instruction to "pick up the center gear within the row of 5 gears on the correct," is given to the mechanism initial it converts the audio directions into text then uses that text to see.

Fig 6.6 Baxter Assembly Robot (Source: engadget.com)

In today"s industries robots are used can collaborate to each other. In China, Great Wall Motors an automotive plant used these robots in welding lines, where welding robots and handling robots collaborates each other, and 4000 welding operation is performed in just 86 second cycle time on a car with transferring operation.
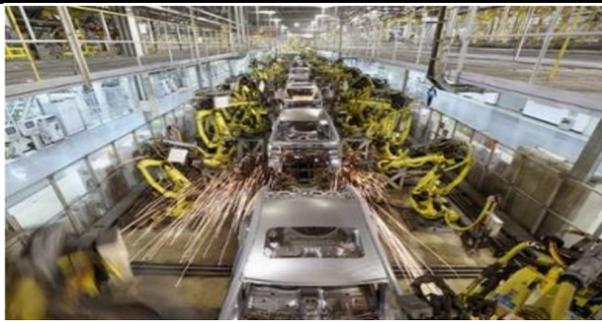
Fig 6.7 Welding robots in GWM plant (Source: engadget.com)

Military: In military AI robots are in development phase, currently, it used very limitedly. The Defence Advance Research Project Agency funds the robotics company Boston Dynamics, Which is developing a 3 feet long, 2.5 feet tall, and 240 pounds robot with 4 legs named BigDog. This robot is able to carry load up to 350 pounds and can travel through snow, ice, mud, rain and in another difficult terrain at speed of 4 miles per hour and even climb a 35-degree incline. It controlled and balanced itself by adjusting its position using data collected by its camera and processed by an on board system installed in it.

Fig 6.8 BigDog (Source: robots-and-androids.com)

US army also used Unmanned Ground Vehicles (UGV), it operates in outdoor and in a variety of terrain. It is autonomous robot tank which gains information from surrounding and makes strategies and travel without any human interaction and avoids harmful situations.

Fig 6.9 UGV (Source: robots-and-androids.com)

VII. LIMITATIONS

AI robots make life easy and simple but there are limitations in some areas, such as military because it is dangerous offensive autonomous robot use AI to select and kill without any intervention of human that means robots decide when to eliminate people that totally based on pre-selected criteria. If machine became more intelligent than human or in another word super-intelligent then humans future is shaped as AI preferences. The AI robots able to perform almost all tasks which any human can do and even better than human, but some tasks like imagination, dreaming which lead humans towards some new innovation is not possible in present scenario but it might be possible in future.

VIII. FUTURE SCOPE

As stated above AI Robotics has a great scope in almost every area. From the ancient time to modern day‟s surgery is still done manually, so, there is always some risk to the life of the patient, but what if we deploy some Artificial Intelligent Robots which perform the surgery, it reduces the risk of the patient live as well as it is more accurate than a surgeon.

In space, in next few years we will move beyond our solar system, hence we face lots of technical and connection problem, as the distance is so far it takes a long time to receive and send the command to the probe, so, in that situation AI Robots are very helpful because it has the capability to take decision on its own in some critical situation.

In the military, transportation is one of the major problems for a soldier, so it is very helpful to deploy autonomous robots which carry the loads and able to travel in any type of terrain. Also in next few years, it is possible that humanoid robots take place in the military and ready to face the enemy. There are several other areas like industries, rescue operation, entertainment where AI Robots are used extensively.

IX. CONCLUSION

However, the use of AI Robots is limited in present society, but now as the world moves towards automation the demand of AI Robots increased rapidly and new innovations are done in this field in next few years we will see these intelligent robots working everywhere along with humans. As the use of intelligent robots increased it causes some security issue for mankind because evolution of human brain is slower as compared to artificial intelligence, then it might possible that AI exceeds the human intelligent, but on another hand it is also very helpful for mankind because it can perform all such task which is not possible for humans.

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REFERENCES

[1]http://thepitcher.org/10-quotes-give-different-perspective-artificial-intelligence/
[2]https://www.brainyquote.com/quotes/keywords/robots.html
[3] https://medium.com/towards-data-science/a-gentle-introduction-to-neural-networks-series-part-1-2b90b87795bc
[4] http://www.bbc.com/news/technology-30290540
[5]https://spacedoutscientist.com/2015/10/11/artificial-intelligence-robots-consciousness/
[6]https://www.nasa.gov/centers/ames/research/exploringtheuniverse/spiffy.html
[7]https://spectrum.ieee.org/the-human-os/biomedical/devices
[8]https://www.engadget.com/2017/09/11/human-robot-ai-manufacturing/ [9]https://www.tutorialspoint.com/artificial_intelligence/
[10]http://www.robots-and-androids.com/military-robots.html
[11]https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
[12]https://blog.robotiq.com/bid/69722/Top-5-Robotic-Applications-in-the-Automotive-Industry
[13]https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_neural_networks.htm
[14] https://en.wikipedia.org/wiki/Robotics
[15]https://www.tutorialspoint.com//mahout/mahout_machine_learning.htm
[16] https://en.wikipedia.org/wiki/Artificial_intelligence