

Advancements in Robotics and Its Future Uses

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Abstract--The future is not written yet and who knows whether robots are dangerous or not. What is for sure is that humans, being the curious beings, will develop new advanced generations of robots. Robots and other high-performance inventions have always been of a vast interest for humanity. A great number of scientists have spent the whole life in their laboratories with one aim "to work out innovative schemes, develop them and create some highest qualitative ranking robot". This engrossing process has reached its peak with the technical push that took place due to the endeavors of a number of brilliant and clear intellects of scientists all over the world. The most striking fantasies in this sphere are brought successfully into reality and a great number of robots are in service of people in order to make the process of work or manufacturing automatic. It happens so that people and robots go together in this life side by side, in some spheres of life they are even interchangeable and who knows into what this opposition "Human and Robots" will translate. The future of robots is mere speculation, but judging from developments in recent years, the continued advancements in technology are a foregone conclusion. Robots will likely continue to impact various aspects of our lives, and scientists and philosophers continue to debate the possibilities for the human race. As artificial intelligence continues to develop, there may be a point in which robots become superior to mankind. No matter the future holds, robots will have a place in it.

Index Terms— LEMUR; Robotics; Robots; Robocup; Military bots; Social bots; Swarm Robotics;



1. INTRODUCTION TO ROBOTS

What is the first thing that comes to mind when you think of a robot?

For many people it is a machine that imitates a human—like the androids in Star Wars, Terminator and Star Trek: The Next Generation. However much these robots capture our imagination, such robots still only inhabit Science Fiction. People still haven't been able to give a robot enough 'common sense' to reliably interact with a dynamic world.

The type of robots that you will encounter most frequently are robots that do work that is too dangerous, boring, onerous, or just plain nasty. Most of the robots in the world are of this type. They can be found in auto, medical, manufacturing and space industries. In fact, there are over a million of these type of robots working for us today.

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But what exactly is a robot?

As strange as it might seem, there really is no standard definition for a robot. However, there are some essential characteristics that a robot must have and this might help you to decide what is and what not a robot is. It will also help you to decide what features you will need to build into a machine before it can count as a robot.

A robot has these essential characteristics:

- **Sensing** First of all your robot would have to be able to sense its surroundings. It would do this in ways that are not similar to the way that you sense your surroundings. Giving your robot sensors: light sensors (eyes), touch and pressure sensors (hands), chemical sensors (nose), hearing and sonar sensors (ears), and taste sensors (tongue) will give your robot awareness of its environment.
- **Movement** A robot needs to be able to move around its environment. Whether rolling on wheels, walking on legs or propelling by thrusters a robot needs to be able to move. To count as a robot either the whole robot moves, like the Sojourner or just parts of the robot moves, like the Canada Arm.
- **Energy** A robot needs to be able to power itself. A robot might be solar powered, electrically powered, battery powered. The way your robot gets its energy will depend on what your robot needs to do.
- **Intelligence** A robot needs some kind of "smarts." This is where programming enters the

pictures. A programmer is the person who gives the robot its 'smarts.' The robot will have to have some way to receive the program so that it knows what it is to do.

So what is a robot?

Well it is a system that contains sensors, control systems, manipulators, power supplies and software all working together to perform a task. Designing, building, programming and testing a robots is a combination of physics, mechanical engineering, electrical engineering, structural engineering, mathematics and computing. In some cases biology, medicine, chemistry might also be involved. A study of robotics means that students are actively engaged with all of these disciplines in a deeply problem-posing problem-solving environment.

2. SWARM ROBOTICS

Swarm robotics is a new approach to the coordination of multirobot systems which consist of large numbers of relatively simple physical robots. The goal of this approach is to study the design of robots (both their physical body and their controlling behaviors) such that a desired collective behavior emerges from the inter-robot interactions and the interactions of the robots with the environment, inspired but not limited by the emergent behavior observed in social insects, called swarm intelligence. It has been discovered that a set of relatively primitive individual behaviors enhanced with communication will produce a large set of complex swarm behaviors.

Unlike distributed robotic systems in general, swarm robotics emphasizes a large number of robots, and promotes scalability, for instance, by using only local communication. Local communication is usually achieved by wireless transmission systems, using radio frequency or infrared communication.

Potential application for swarm robotics include tasks that demand for extreme miniaturization (nanorobotics, microbotics), on the one hand, as for instance distributed sensing tasks in micromachinery or the human body. On the other hand, swarm robotics is suited to tasks that demand for extremely cheap designs, for instance a mining task, or an agricultural foraging task. Artists are using swarm robotic techniques to realize new forms of interactive art installation. Both miniaturization and cost are hard constraints that emphasize simplicity of the individual team member, and thus motivate a swarm-intelligent approach to achieve meaningful behavior on swarm-level.

Further research is needed to find methodologies that allow for designing, and

reliably predicting, swarm behavior, given only features of the individual swarm members. Here, video tracking is an essential tool for systematically studying swarm-behavior, even though other tracking methods are available. Recently Bristol robotics laboratory has developed an ultrasonic position tracking system for swarm research purposes.

3. FUTURE OF ROBOTICS - ROBOTS USES, TRENDS, APPLICATIONS

The bots until a decade back, used to be just fun and were more toys for tinkerers and scientists (except in Japan of course). But now the robots are beginning to be seen in many social places. We are used to chuckling at stories from Japan of robots serving coffee and greeting visitors to homes. But know what, these mechanical humans are here with us now, in London, in New York and whoa! even in my country, India. And when I read about predictions that robots in future could love and gasp!, go even one step beyond, I felt it was time I compiled a list of resources for what the future held in store for robotics. What are scientists predicting for the bots' future? What do the experts think? And who do those always fascinating sci-fi writers and futurists say after gazing at their crystal balls?

4. INDUSTRIAL, PROFESSIONAL & MILITARY APPLICATIONS

Robots: The Future is now - Robots are already a part of our lives. Industrial robots widely used in manufacturing. Military and police organizations use robots to assist in dangerous situations. Robots already have a significant role in medicine. Robots are helping doctors achieve more precision in the operating room, performing safer, less invasive techniques

Future of Robotics for Civil Use - Caterpillar plans to develop remote controlled machines and expects to develop fully autonomous heavy robots by 2021. Some cranes already are remote controlled It was demonstrated that a robot can perform a herding task. Robots are increasingly used in manufacturing (since 1960s). In auto industry they can amount for more than half of the "labor". There are even "lights off" factories such as an IBM keyboard manufacturing factory in Texas that are 100% automated. Robots such as HOSPI are used as couriers in hospitals, etc. Other hospital tasks performed by robots are receptionists, guides and porters helpers, (not to mention surgical robot helpers such as Da Vinci) Robots can serve as waiters and cooks.

Bots on The Ground - The most effective way to find and destroy a land mine is to step on it. This

has had results, of course, if you're a human. But not so much if you're a robot and have as many legs as a centipede sticking out from your body. That's why Mark Tilden, a robotics physicist at the Los Alamos National Laboratory, built something like that.

Surgical Robotics - Surgical Robots towards autonomy:

- * Current surgical robots are tactical: every move authorized by a surgeon
- * Telesurgery already requires local autonomy
- * Miniaturization and new MIS techniques lead to strategic robots
- * Robotics will become ubiquitous in future

Applications for Robot: Applications for robot insects

- * Tasks on terrain unsuitable for wheeled robots
- * Animal modeling
- * Remote handling
- * Remote location exploration
- * Entertainment/home projects
- * Robot insects could be used for tasks that involve transportation, exploration and surveillance, especially for tasks that are inhospitable for humans.

Mobile Robot Suits Material Handling Applications

- Employing Industrial Mobile Robotics technology, vision-guided Model GT3 moves through manufacturing, warehousing, and distribution operations utilizing stereo cameras to build 3D map of environment. It then uses map and its own reasoning ability to navigate predetermined path to complete assigned transport task. Designed to free up skilled employees, GT3 pulls carts, delivers palletized materials, and positions supplies without wire guides, magnets, or lasers. Military Robots of the Future - Since Robby the Robot first appeared on screen in 1956's Forbidden Planet, science fiction in print, film and on television has pushed the limits of our imagination regarding machines of the future and their abilities to perform human tasks.

5. SOCIAL BOTS

Robots! More robots! And they're in Your House!

Robots of the future will look nothing like R2D2 in Star Wars, but resemble computer chips embedded in everyday appliances, such as vacuum cleaners and cell phones, if companies like Evolution Robotics Inc. have anything to do about it. With the vision-based robotic technology you can point your cell phone at a movie poster, take a picture, and the technology will go out to the Web and download the movie's trailer to your phone.

Robotic Rats Will get a Sense of Touch - An international team composed of robot designers and brain researchers is looking at nature to develop a new generation of robots with active touch sensing abilities. The BIOTACT (Biomimetic technology for vibrissal active touch) project is developing whiskered robot rats which might help in rescue or search missions under conditions of restricted visibility, and even for planetary research

Home Robots Grow In Popularity - We are moving beyond the stage where robots were used only in controlled and therefore relatively simple factory environments. The home and the surgical operating table are both much more complicated environments with more unplanned and unexpected elements that can show up. Recent advances in robotic vehicles demonstrate the potential for robotic systems to handle complex environments outside of factories. The success of robots in the mass market will provide revenue flows to fund the development of more robotic products. We should expect the introductions of new kinds of home and workplace robots in the next few years. Robots are a growing part of our everyday lives.

Robot Future Poses Hard Questions - Scientists have expressed concern about the use of autonomous decision-making robots. As they become more common, these machines could also have negative impacts on areas such as surveillance and elderly care, the roboticists warn. The development and eventual deployment of autonomous robots raises difficult questions. The more pressing and serious problem is the extent to which society is prepared to trust autonomous robots and entrust others into the care of autonomous robots

Future Vision: Cheap Robots Change the World
Virtual Travel: People will be able to visit each other without traveling. They will do this by taking control of a robot at their desired vacation destination, and use the Internet to transmit all the sensory information back and forth

- * Housekeeping
- * Machines will do the routine chores around the house
- * Robots will be inexpensive

6. EXOTIC STUFF

Self-healing Mini Robots for Search and Rescue Operations - It is believed that the self-healing robots will be able to dock with each other, share energy, and co-operate to maximise their abilities to achieve different tasks. Researchers from 10 universities are associated with the project. They say that future applications include

search and rescue missions, space exploration, and medicine. "A swarm could be released into a collapsed building following an earthquake. They could form themselves into teams searching for survivors or to lift rubble off stranded people".

Robots Fly into Antarctic Skies - A pair of lightweight, robotic planes have made the first unmanned flights over Antarctica's icy expanses. Driven by propeller, the machines made 20 low-altitude sorties, including four over the Weddell Sea. The unmanned aerial vehicles (UAVs) were launched by catapult but flew autonomously until landing. During some of the test flights the machines were fitted with miniaturized instruments to collect data for use in predictive climate models

Brain Machine Interface - In January, Miguel A. L. Nicolelis announced that his team completed the first steps toward a brain machine interface that might make it possible for paralyzed people to walk by directing devices with their thoughts. The team's monkey, in North Carolina, demonstrated the power of the technology when she used her brain signals to make a robot in Japan walk.

Robots in the field of MUSIC

Many regard music as the universal language. But getting robots to speak any language is harder than it seems. Eric Singer, a musician who also holds an electrical and computer engineering degree, founded LEMUR, or the League of Electronic Musical Urban Robots, in 2000 as a means of combining musical instruments and robotics. The group, according to Singer, has "had about 100 members in the form of contributing artists, technologists, and apprentices." It has already created a variety of robotic instruments. Some of the most memorable include GuitarBot, a four-stringed robot that plucks strings – the pitch can be altered by moving sliders up and down the strings. In addition, some robots can be manipulated by humans. Many of his instruments have intrigued musicians looking for something new. Besides musical instruments, one can program performance systems that interact with live performances. One, called Cyclops controls a variety of stage equipment including cameras, audio, video, and robotics.

One of the goals of LEMUR is to find new ways to create music. The current reality is that 99 percent of the music that is created involves the use of electronics and technology in some way or another. Short of beating drums around a bonfire, musicians are going to use technology in some part of recording, performing, or creating music. The main focus is on exotic and lesser-known instruments, and also non-musical objects.

Robots in Sports:-

The Robot World Cup Initiative is an attempt to foster AI and intelligent robotic research by providing a standard problem, playing soccer, where wide range of technologies can be integrated and examined.

Multi-agent systems represent a growing area of research in the AI community, but mostly due to the variety of applications in which multi-agent systems have been used, contacts and exchanges between groups of researchers working in this domain have not been so frequent. The RoboCup offers the possibility to confront and exchange ideas in a common domain and encourages researchers to establish and keeping contacts with each other.

In several European countries, soccer clubs use Artificial Intelligence technology when administering physical examinations to players to help trainers and coaches determine the likelihood of a player developing an injury. The machine collects the player's biomedical data and compiles it with other records and signs of illness. Once the information is analyzed, the technology can spot injuries, or potential injuries, much more quickly and effectively than a doctor or coach may be able to. Athletes' personalities and psychological profiles can also be stored in the machine, and can be used to guess the way people will act or perform in different situations. Some scientists are still skeptical, wondering how accurate the hollistic, cut-and-dried decisions made by robots will be when dealing with atypical or complicated situations. However, most agree that the technology has potential as long as the computer and the coaches use actual soccer experience to judge players' physical and mental fitness.

Not only are robots used to examine human players, but some also actually play the sport as well. The RoboCup is an international competition in which competing teams—usually from universities—create teams of robots that play soccer against each other. The robots have to be autonomous and self-propelled. The creators cannot use any kind of remote control to operate the robots. The contest includes several categories, including humanoid, four-legged, small, and middle-sized, and it has taken place in many different countries including Japan and Germany. Younger students can participate in the RoboCup Junior competition and compete against other primary and secondary school students. The RoboCup Junior was designed to teach younger children about robotics and Artificial Intelligence.

The ultimate goal of this international program is to have a team of fully autonomous humanoid robots beat a human world champion team by 2050. The robot-sportsmen must incorporate many different types of technology and strategy in order to be successful.

7. FUTURE PREDICTIONS: Bill Gates Stumps for Robotic Future -

Microsoft Chairman Bill Gates lays out the robotic future in the cover story of January's Scientific American magazine, which has a C-3PO type robot on the cover. In the story, Gates argues that the robot industry is akin to the PC industry 30 years ago. Robots lack standards and don't have a common OS, processor or code base. And guess who wants to be that standard OS? Microsoft.

Robotics - What Next? - The robotics industry, while in development for half a century, is still relatively in its infancy and faces a number of challenges in the years ahead. Besides the technological and cultural hurdles to overcome, questions remain unanswered regarding their economic and environmental impacts as well as the ethical issues of human and robot interaction. What is obvious is that robots, whatever form they take, will increasingly play a role in societies around the world and that the ecosystem of services and capabilities will offer increasing opportunities for designers in the years to come

Bots with Brains: Future Robotic Overlords?

Science fiction has portrayed machines capable of thinking and acting for themselves with a mixture of both anticipation and dread, but what was once the realm of fiction has yet again become the subject of serious debate as robots become more intelligent. In 1981, Kenji Urada hopped a safety fence at a Kawasaki plant to carry out maintenance work on a robot. While working on the machine, the robot reached out and pushed 37-year-old Japanese factory worker into a grinder with its powerful hydraulic arm. Urada's death is often said to mark the first recorded victim to die at the hands of a robot, although Robert Williams was killed by a robot two years earlier. Since both deaths, and despite the introduction of improved safety mechanisms, there have been many more gruesome industrial fatalities involving robots crushing humans, smashing their heads and even pouring molten aluminum over them. So will the robots be our future overlords, overstepping the bounds that humans had prescribed for them?

Robotics Technology Trends - Despite the wishes of robot researchers to emulate human appearance and intelligence that simply hasn't happened. In most robots versatile and rapid object recognition is still not quite attainable. And there are very few examples of bipedal, upright walking robots such as Honda P3, mostly used for research or sample demonstrations. Today, simple pattern matching vision sensors can be purchased for under \$2,000. The price reductions reflect today's reduced computing costs, and the focused

development of vision systems for specific jobs such as inspection.

The Future of Robotics - From vacuum cleaners and lawnmowers to military landmine detectors, robots are becoming increasingly present in our daily lives. MIT's Computer Science and Artificial Intelligence Laboratory possess a humanoid robot named Domo, its creator, PhD student Aaron Elsinger, and the man behind all the magic, CSAIL director Rodney Brooks. Israel is developing a robot the size of a hornet to attack terrorists. And although the prototype will not fly for three years, killer Micro Air Vehicles, or MAVs, are much closer than that.

How Robots Will Affect Future Generations -

The future for robots is bright. But, how will robots affect future generations? Sometimes you can get ideas for the future by looking into the past and thinking about the changes we've seen as a result of other great inventions, like the cotton gin, airplane or Internet. Perhaps one day we will have true robotic "helpers" that guide the blind, assist the elderly. Maybe they'll be modular devices that can switch from lawn mower to vacuum cleaner, to dish washer and window washer.

What Does the Future Hold for Robot Applications?

If you ride in a car, an industrial robot helped build it. If you eat cookies, such as the Milano brand from Pepperidge Farm, there are robot assembly lines to help make and pack them. The computer you use to send e-mails and use for research almost certainly owes its existence, in part, to industrial robots. Industrial robots are even used in the medical field, from pharmaceuticals to surgery.

8. CONCLUSION

It is evident from the above provided details that the robots have proved time and again that they can do the impossible. Man's short stay in this planet is influenced by these machines created by the human brain. Hopefully in a few years these man-made machines or the so called "Brain child of mankind" doesn't dominate and overpower its own creator. In conclusion, we need to draw a boundary between humans and machines such that we prevent any kind of hick-ups during our cameo on earth.

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