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Artificial Intelligence Robotics: Services and Future roadmap

Mrs. Swati Namdev and Mrs. Karuna Nidhi Pandagre

Asst. Prof.,
Department of Computer Science,
Career College, Bhopal(M.P.) India

ABSTRACT: This paper is about the future of robotics for civil use. Cooperation between robots with different capabilities is one of the aspects which can influence on the future of robotics. In this situation coordination is an important factor which must be take to account for making a robust behavior for each robot. Robots are being used across the various domains of manufacturing, services, healthcare/medical, defense, and space. Robotics was initially introduced for dirty, dull, and dangerous tasks. Today, robotics is used in a much wider set of applications, and a key factor is to empower people in their daily lives across work, leisure, and domestic tasks.

KEYWORDS: branch, engineering, technology, design, research, computer.

1 INTRODUCTION

Robotics is the branch of technology that deals with the design, drawing, construction, production, operation, and application of robots, [1] as well as computer system for their control, sensory feedback, and information processing. The design of a given robotic system will often incorporate principles of mechanical engineering, electronic engineering, and computer science (particularly artificial intelligence). The study of natural systems often plays a key role in the systems engineering of a project and also forms the field of bionics. The mathematical expression of a natural system may give rise to control algorithm for example, or by observing how a process is handled by nature, for example the bifocal visualization system, an equivalent system may be formed using electronics.

The idea of creating technology that can function separately dates back to conventional times, but research into the functionality and potential uses of robots did not grow substantially until the 21st century[2].Throughout history, robotics has been often seen to mimic human behavior, and often manage tasks in a similar fashion. Today, robotics is a rapidly growing field, as technological advances continue; research, design and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots do jobs that are hazardous to people such as defusing bombs, mines and exploring shipwrecks.

This paper summarizes the current state of robotics, and previews the findings of a robotics road mapping effort currently under way. Robotics originated with the goal of building human-like machines, but it has become much more than that. Even though we are still decades away from human-like machines, the developing robotics technologies are proving useful in ways that nobody expected: robot-assisted noninvasive surgery; disposal of roadside bombs; automated lab science for drug discovery; even auto-focus features in digital cameras. The broad impact of robotics is proven, even though robotics is still in the early stages of its development.

Robotics thus affords a unique opportunity to make a cross-cutting investing that advances both fundamental research and development in an area vital to U.S. competitiveness while providing the potential for near term job, business development and educational returns. Outlined below are the broad critical application areas for robotics. The creation of a $100 million initiative to be matched by industry to establish test beds in the major application areas could generate nearly

Corresponding Author: Mrs. Swati Namdev

10000 new jobs impacting a wide range of sectors. The specific proposal advanced is to create a competitive process to establish a series of robotics test beds in communities across the nation. These test beds would be devoted to specific health, transportation, agriculture, manufacturing and extended care services. The selected test beds must include large and small industrial partners in the end user community. Recognizing the unique capacity of robotics to be a powerful tool for education, each proposal should incorporate a strategy for the test bed to engage K-12 students and to foster the development of new educational applications. The remainder of the paper addresses the unexpected breadth and significance of robotics.

2 CONNECTING COMPUTERS TO THE REAL WORLD

Robotics transforms the connection of computers to the real world. The significance of this connection is difficult to overstate. To start, consider the role of sensors, and the effect on the World Wide Web, and future networks. At present the World Wide Web is restricted mostly to document and other information provided by humans. Even when cameras and other sensors are attached, our computers and networks are primarily a communications and storage medium. Every advance in the software to analyze and understand the sensory data enables numerous applications.

The cost of the sensors, the computers, and the communications is relatively low, as evidenced by the number of cell phone cameras in use. As our computers achieve even a crude understanding of video imagery, the applications are many, and will profoundly change our lives. The most obvious applications are security: pervasive intelligent security monitors for homes, for borders, and for the civil infrastructure will result, and will become more capable and more affordable as the perception techniques continue to improve.

Computers are fun to play within their own right, but they're best used as a tool to interface with the real world. We use the term "Real-World Computing" to refer to the use of a computer in some kind of real-world situation. This could involve data collection, prediction, controller functions, or anything.

Some of the real-world applications that we were played with are:

- Time - make your computer clock sync up with the world's most accurate atomic clocks
- Weather - real-time weather warnings, forecasts, and information
- GPS - accurate position information anywhere on the planet
- Radio - software defined radio and audio signal processing
- Earthquakes - when the earth moves, you can hear about it
- Astronomy - watching the skies
- Photography - capturing the real world

3 CONNECTING HUMANS TO THE REAL WORLD

Robotics also transforms the connection of humans to the real world. Sensors often transcend the limitations of human perception. They enable us to see far away, to see very small things, to see three-dimensional images of the inside of our bodies, and to integrate imagery from numerous other sensors, such as GPS, motion sensors, and others. This information can be presented to a human in an interactive way, in effect giving a video-game like experience, letting the human experience the world in ways that are now impossible. The most exciting applications are in education.

4 ROBOTICS IN SERVICE

Service robots assist human beings, typically by performing a job that is dirty, dull, distant, dangerous or repetitive, including household chores. They typically are autonomous and operated by a built-in control system, with manual override options. The term "service robot" is less well-defined. The International Federation of Robotics (IFR) has proposed a tentative definition, "A service robot is a robot which operates semi- or fully autonomously to perform services useful to the well-being of humans and equipment, excluding manufacturing operations."[3]

Robotics is about action, and the main goal of that action will be to serve humans. Robotics technology does not resemble common science fiction scenarios. In most instances, robotics technology will be embedded in common objects, and not recognizable as a robot. An example is unmanned vehicles. Vehicles are already driving themselves in certain restricted applications such as shipping yards. Unmanned aerial vehicles are proving themselves, and unmanned ground vehicles are nearing substantial deployment. When passenger cars drive themselves, the result will be dramatic improvements in efficiency and safety, with enormous savings in fuel, insurance, medical bills, and overall a great improvement in the quality

of our lives. Another example is assistive technology in our homes, which can enable the elderly and disabled to live independent lives, rather than moving into institutions.

4.1 TYPES OF SERVICE ROBOTS

The possible application of robots to assist in human chores is widespread. At present there are a number of main categories that these robots fall into.

Industrial

Industrial service robots can be used to carry out simple tasks, such as examining welding, as well as more complex, harsh-environment tasks, such as aiding in the dismantling of nuclear power stations. If the robot is an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications. It is called "Industrial Robot"[4].

Restaurant and bar

Many bars are starting to become automated through the use of robots, even producing complex cocktails. [5] There are also robots used for Waiting. [6]

Domestic

The Roomba vacuum cleaner is one of the most popular domestic service robots.

Domestic robots perform tasks that humans regularly perform around their homes such as cleaning floors, mowing the lawn and pool maintenance.

Scientific

Robotic systems perform many functions such as repetitive tasks performed in research. These range from the multiple repetitive tasks made by gene samplers and sequencers, to systems which can almost replace the scientist in designing and running experiments, analysing data and even forming hypotheses.

Autonomous scientific robots perform tasks which humans would find difficult or impossible, from the deep sea to outer space. Robots in space include the Mars rovers which could carry out sampling and photography in the harsh environment of the atmosphere on Mars.

4.2 EXAMPLES OF SERVICE ROBOTS

- PatrolBot
- CoroBot
- ADAM SGV
- HelpMate
- Cybermotion
- Roomba
- DESIRE

5 GLOBAL COMPETITIVENESS

Robotic technology for manufacturing was originally developed in the United States, but the manufacturing robotics industry is now dominated by Asia and Europe, with serious consequences for US robotics and for US manufacturing. Unlike manufacturing, the service robotics sector is just beginning to develop. Ultimately it will dwarf the manufacturing sector. The United States is well placed, with an outstanding research and development community, and the business infrastructure to encourage innovative applications of the new technology.

6 ROBOTICS ROADMAPPING

Several months ago a group of robotics leaders, drawn from universities, industry, and government labs, formed a roadmapping effort funded by the National Science Foundation. A series of workshops is in progress, with the goal of articulating a national robotics agenda. The goals of the roadmapping effort are: (1) to identify the future impact of robotics on the economic, social, and security needs of the nation; (2) to outline the scientific and technological challenges to address;

and (3) to draft a roadmap to address those challenges and realize the benefits. So far four surveys have been done. Three surveys focused on application areas: manufacturing, service, and medical and healthcare. A fourth survey focused on emerging technologies and trends.

Manufacturing

The manufacturing sector continues to be vital to the US for many reasons. It is an especially significant part of exports. Manufacturing practices are changing rapidly in the types of products that can be produced, the quality with which they are produced, and the speed with which new products can be brought to market. Robotics for manufacturing continues to advance, and may be poised for radical acceleration, fueled both by new fundamental approaches to robotics and automation research, and improvements in many component technologies such as perception, machine learning, and human interfaces.

Medical and Healthcare

Medical robotics is already a major success as use of minimally invasive robots significantly reduces recovery time and risks associated with surgery. Today a large number of prostate procedures are performed with robots, and a significant number of robot-assisted cardiac procedures are performed daily. Robots are also being used for rehabilitation and in intelligent prostheses to help people recover lost function, and socially assistive robots are being developed capable of providing monitoring, coaching, and motivation for encouraging cognitive and physical activities, and minimizing isolation and depression. Today US are the leader in robot assisted surgery.

Service

The service sector includes both professional and domestic services. Professional service robots are used in logistics, agriculture, cleaning, and mining. A logistics example is harbor automation to ensure increased inspection of containers to improve homeland security. In agriculture, the primary need is to increase productivity to ensure continued economic viability. In mining, robots are used to increase efficiency but also to increase safety. Other professional services include warehouse management, automatic surveillance of areas etc. Domestic service robots include automatic floor care such as vacuuming. Already today more than 3 million home robots have been deployed. Robots in the home are essential to reduce time spent on daily chores and enable the elderly to maintain a clean and organized home. Today the US is the leader in service robotics.

The fourth survey addressed emerging technologies and trends. Robotics integrates many different component disciplines and technologies. Robotics has often been driven by advances in these component technologies, and in return robotics has often provided the applications that have motivated these advances. The roadmapping effort identified 63 different technological advances which promise to impact robotics, and 35 different new applications which will be enabled by various advances. A few specific technology areas of significance are micro and nano-technology, sensors and motors, the theory and engineering of analyzing and controlling dynamic systems, communication and networking, theory and practice in machine learning, and human interface software. A national initiative in robotics would address many national priorities. It would ensure future competitiveness and hence employment in a rapidly growing sector. It would directly affect the effectiveness of our nation's military and the security of the homeland. It would enrich our lives by bringing outstanding educational opportunities, good jobs, greater safety, better health care, personal security, and a level of independence and freedom that only our wealthiest citizens presently enjoy.

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