

Medical Robotics - Robots and Associated Computing Technology for Medical Applications



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Abstract: *We take birth, we live and finally we all die. During the short time we live, we all want to be happy. Happiness comes when you are healthy, more the healthier you are- more the happiness. There are various types of robots depending on the area in which they are made use of. Medical robots are used to assist doctors, surgeons and other healthcare workers. The most advanced aspect of medical robotics is surgical robotics, in which a robot actually performs surgery. It might be surprising to know that in few top hospitals the top performing surgeon might not be a human being. Apart from surgeries, robots can be used to perform various other jobs within the healthcare industry. In this paper, we see how robots can reduce the strain of healthcare workers by reducing and automation their job.*

Keywords : *Robots, medical robots, surgical robots, healthcare*

I. INTRODUCTION

As we all know, a robot is a computer programmable machine which is competent enough to carry out convoluted tasks on its own. A robot can be either controlled externally or a chip maybe embedded within it. Robotics is a branch which deals with the design, development, operation and application of robots for their sensor analysis and information processing is called robotics [1]. Robotics is actually an interdisciplinary engineering branch including mechanical, electrical, electronics and computer engineering. It brings along various types of engineering for various things such as we need mechanical engineering for building a robot containing metal body, we would be requiring electrical and electronic engineering for using motors and powering the motors, finally we would be needing computer engineering to collect and process the data that robot collects. We can deploy robots to do the job where the situation or environment is hazardous or difficult for human beings.

There are various types of robots depending on the area in which they are made use of. Service robots are used to assist human beings in performing duties that are especially dangerous, dirty or repetitive. Military robots are autonomous

and are designed for military operations such as transportation of goods, searching, attacking and rescuing. Medical robots are used to assist doctors, surgeons and other healthcare workers. It might be surprising to know that in few top hospitals the top performing surgeon might not be a human being. While there might be concerns about a machine replacing humans in a critical area such as healthcare, there are many benefits such as a machine need not require sleep which can be useful in situations which demands 24x7 monitoring of a patient. With more precision and training, robots can be used as a reliable ally as far as healthcare industry is concerned. Apart from surgeries, robots are also used in various other ways within the healthcare area which we will discuss in next section of the paper.

II. MEDICAL ROBOTS – MAKING HEALTHCARE EFFICIENT THROUGH TECHNOLOGY

If you go by a recent report of Credence Research, the market for medical robotics would grow from \$7.24 billion in 2015 to around \$20 billion by 2023 such is the scope for robots in the healthcare industry [2]. Medical robotics is an advanced discipline within the field of robotics which involves the development of robots that can perform various medical tasks. Medical robots have the potential to reduce the strain of the healthcare workers by automating most of the tasks [3]. We take birth, we live and finally we all die. During the short time we live, we all want to be happy. Happiness comes when you are healthy, more the healthier you are- more the happiness. Healthcare industry has come a long way since its inception; surgeries which were taking hours together could be performed within minutes nowadays with the help of the technology. The most advanced aspect of medical robotics is surgical robotics, in which a robot actually performs surgery. Medical robots perform minimally invasive surgery, a surgery done by small incisions which has helped doctors operating on few things which were not possible earlier. Even though the technology has helped us achieve many milestones, it is not fully automatic as yet. A surgeon usually controls the robot which performs the surgery. Surgery robots provide numerous benefits due to the motion and the precision they operate to minimize the side effects due to the operation [4]. Benefits for the patients of a robot assisted surgery would be minimal blood loss, less risk of infection, minimal use of anesthesia among others [5].

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Robots to be a reliable ally must be able to work with high precision and with minimal human intervention, for this to happen machine must learn things and become intelligent. To make a machine intelligent, usually artificial intelligence is made use of. One other way of using robots apart from surgery is physiotherapy. Physiotherapy usually involves massages for muscle relaxation, in which robots can replace humans. Pharmacy is one place where the robots could be employed; robots could scan the prescriptions with the help of barcodes, pack the correct drugs and track the delivery so that right medicine reaches the right patient [6]. possible.



Fig.1 Da Vinci surgical robot

III. APPEALING FACTS ABOUT MEDICAL ROBOTS

Medical robots are used to assist doctors, surgeons and other healthcare workers. It might be surprising to know that in few top hospitals the top performing surgeon might not be a human being. While there might be concerns about a machine replacing humans in a critical area such as healthcare, there are many benefits such as a machine need not require sleep which can be useful in situations which demands 24x7 monitoring of a patient. With more precision and training, robots can be used as a reliable ally as far as healthcare industry is concerned. Apart from surgeries, robots are also used in various other ways within the healthcare area. In jobs that are repetitive and monotonous, robots could actually replace humans entirely. We will see few facts about robots performing various jobs in the healthcare industry [7] [8] [9]:

1. Robotic surgery: As discussed in previous section, we can use robots to perform surgeries by using small, precise and minimally invasive tools. These robots are entirely controlled by surgeons and it offers more exact surgical movements and a wide range of motions within the small surgical area, so all we would need is small incisions which results in quick healing and fewer scars. Due to several advancements in technology, 3D view of surgical area is possible with 7 degrees-of-freedom motions. Fig.1 give an image of the Da Vinci surgical robot which is a surgical robot [10]

2. Less risk of infections: Xenex robot is used to reduce infections. It works by emitting high intensity of xenon UV rays which destroys viruses and bacteria around 4-10 minutes. The microbots which are robots that are less than 1mm can travel through specific parts of the body to destroy tumors, blood clots and the infections which might be easily accessible.

3. Reception duties at hospital: Pepper robots are being used as receptionist at 2 Belgian hospitals. This pepper robots has the capability to recognize 20 different languages and is also capable to detect whether its talking to a man, women or a child. Pepper can be employed as a receptionist in big hospitals and they can also accompany visitors to the correct departments so that they won't get lost. Social robots such as Pepper might also be useful in assisting exercise sessions and help children overcome fears of surgery.

4. Augmenting Humans: One of the most promising reasons for developing medical robots are machine comrades which extend human senses to compensate for frailties and deficits. Medical robots could assist elderly and also help medical experts in performing sophisticated tasks with greater precision and accuracy. Bandit, a robot developed by USC provides social cognitive support for the elderly by engaging them in various tasks and also serves as a therapist to children with autism. A pneumatic robot also has been designed that adjusts patients limbs in correct position inside an MRI position so that more accurate diagnosis is possible.

5. Reducing stress for patients: As we know, pet animals help us relax which in turn reduce stress. Pets also help us in diverting attention from pain and reduce the feeling of loneliness. But most of the hospitals won't allow pets inside the premises. PARO, a robot developed by AIST, a Japanese industrial automation pioneer allows benefits of animal therapy administered to patients in medical environments in shape of a baby seal covered with soft fur. This robot is found to reduce stress factor experienced by patients. Advantage of PARO is that it never needs to be fed and it never dies.

IV. CONCLUSION

Medical robots are used to assist doctors, surgeons and other healthcare workers. The most advanced aspect of medical robotics is surgical robotics, in which a robot actually performs surgery. Medical robotics is an advanced discipline within the field of robotics which involves the development of robots that can perform various medical tasks. With more precision and training, robots can be used as a reliable ally as far as healthcare industry is concerned. Apart from surgeries, robots are also used in various other ways within the healthcare area. We saw few facts and jobs that robots perform currently and also few future trends of robot technology.

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Chethan Sharma is an assistant professor in the department of ICT, MIT, Manipal. His research interests include Machine Learning and Deep learning. He has published papers in various international conferences and journals. He is currently working on a research project based on deep learning.