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Makanov D., Vanik I.

The Robot Application in Medicine

Belarusian National Technical University
Minsk, Belarus

In the modern world, it is impossible to imagine anything without computer technology. Computers, robots, Internet technologies are common in every field of human activity, in every corner of the world. Thanks to them, you can get to know the world better, get the necessary information faster, make complex analysis and calculations for research easier. Information technologies, including robots, help us in various areas of human life, for instance, construction of houses, transportation, space exploration and so on. Besides, they are also very useful in medicine.

Currently, a wide range of robots is being developed to serve in a variety of roles within the medical environment. Robots specializing in human treatment include surgical robots and rehabilitation robots. The field of assistive and therapeutic robotic devices is also expanding rapidly. These include robots that help patients rehabilitate from serious conditions like strokes, empathic robots that assist in the care of older or physically / mentally challenged individuals, and industrial robots that take on a variety of routine tasks, such as sterilizing rooms and delivering medical supplies and equipment, including medications [1].

Below there are six top uses for robots in the field of medicine today: surgical assistants, rehabilitation robots, diagnosis of diseases, medical transportation robots, sanitation and disinfection robots, and robotic prescription dispensing systems [1].

Robotic surgery, or robot-assisted surgery, allows doctors to perform many types of complex procedures with more precision, flexibility and control than is possible with conventional techniques. Robotic surgery is usually associated with minimally invasive surgery — procedures performed through tiny incisions. It is also sometimes used in certain traditional open surgical procedures [2].

Surgeons who use the robotic system find that for many procedures it enhances precision, flexibility and control during the operation and allows them to better see the site, compared with traditional techniques. Using robotic surgery, surgeons can perform delicate and complex procedures that may have been difficult or impossible with other methods [2].

Very often robotic surgery makes minimally invasive surgery possible. The benefits of minimally invasive surgery include: fewer complications, such as surgical site infection, less pain and blood loss, quicker recovery and smaller, less noticeable scars [2].

The University of Oxford has conducted a trial of PRECEYES Surgical System. The test involved 12 patients who needed membranes removed from their eyes or had a buildup of blood underneath the retina due to age-related macular degeneration. Half of the people got conventional procedures, while the others received robotic surgeries.

All the surgeries were successful, but the robotic approach was at least as successful and was sometimes even more effective than doing the procedures manually. There are plans to use the surgical robots to dispense gene therapy to the retina.

Rehabilitation robot is any automatically operated machine that is designed to improve movement in persons with impaired physical functioning [3].

There are two main types of rehabilitation robots. The first type is an assistive robot that substitutes for lost limb

movements. Powered wheelchairs are another example of teleoperated, assistive robots [3].

The second type of rehabilitation robot is a therapy robot, which is sometimes called a rehabilitator. Research in neuroscience has shown that the brain and spinal cord retain a remarkable ability to adapt, even after injury, through the use of practiced movements. Therapy robots are machines or tools for rehabilitation therapists that allow patients to perform practice movements aided by the robot. The first robot used in that way, MIT-Manus, helped stroke patients to reach across a tabletop if they were unable to perform the task by themselves. Patients who received extra therapy from the robot improved the rate of their arm movement recovery. Another therapy robot, the Lokomat, supports the weight of a person and moves the legs in a walking pattern over a moving treadmill, with the goal of retraining the person to walk after spinal cord injury or stroke.

Limitations in functionality and high costs have restricted the availability of rehabilitation robots. Furthermore, teleoperating a robot arm to pick up a bottle of water and bring it to the mouth is time-consuming and requires an expensive robot. To overcome that problem, engineers have worked to build more intelligence into robot arms on wheelchairs. Progress in neuroscience stands to significantly advance the development of rehabilitation robots by enabling the implantation of computer chips directly into the brain so that all a user has to do is “think” a command and the robot will do it [3].

Based on the data carried out in this work, we can conclude that the robots used in medicine today are at a sufficient level to treat defects that are quite complex and invisible to a human eye. In feature the creation of computer 3D models of problem areas of the body will allow doctors to better see and understand the specific problem of the patient. It

will undoubtedly improve the quality of diagnosis and treatment of the disease. The robots used in surgery also make the rehabilitation period of patients easier, because of just performing a pair of incisions instead of applying extra incisions to the patient, thereby prolonging his rehabilitation period. In addition, such robots make it possible to carry out very complex operations on very small, sometimes inaccessible to ordinary surgeon's hands, body parts such as human eyes, various areas of the brain, and so on.

Besides, the techniques used to maintain human life, such as exoskeletons, mechanical arms and legs, apparatus for supporting the work of internal organs allow a person to cope with his life problem and continue to live, despite his difficulties.

Thus, today robots play a significant role in medicine, helping both doctors in diagnosis and patients in the treatment of diseases and maintaining their normal life.

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