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APPLICATION OF ROBOT DA VINCI IN MEDICINE

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Abstract. *Use of robotic assistance, their widespread support, human-robot production, increase robotic assistance.*
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Introduction

The history of the development of surgical robotic systems begins in the 80s of the 20th century. As the United States began to develop its massive space program, program managers asked what would happen if astronauts needed emergency surgery in orbit. Of course, creating a separate space station or module with a regular operating room and a permanent team of surgeons was impractical. Specialists from the American Space Agency (NASA) were working on solving this problem.

In 1985, for the first time in the world, the Puma 560 robotic surgical system was introduced, which found its application in neurosurgery.

Later, the PROBOT manipulator appeared for surgical treatment of transurethral resection of the prostate gland.

In 1992, the RoboDoc system was developed to provide surgical assistance in the field of orthopedics when performing joint prostheses.

In 1993, Computer Motion Inc. The Aesop robotic system has been developed. It was an “automatic machine” for fixing and changing the position of the video camera during laparoscopic operations. This setup is still used in some clinics.

These systems were highly specialized and helped to perform only certain stages of surgical operations. These were not completely robotic systems.

In 1998, the first universal robotic system “ZEUS” (“Zeus”) was presented to world medicine.

In the late 90s, Intuitive Surgical Inc developed a universal robotic surgeon capable of performing operations on various nosologies. This robot was named “Da Vinci” (“Da Vinci”) in honor of the great inventor Leonardo da Vinci, who at one time created the first anthropomorphic robot capable of moving legs and arms, as well as performing other actions.

In 2000, the US Food and Drug Administration (FDA) approved the Da Vinci surgical robot for medical operations.

In March 2001, Health Canada approved the use of the da Vinci surgical robot for abdominal and thoracic surgery.

II. Main Part

Da Vinci's robotic system allowed surgeons to operate on patients without even touching them. The doctor, located a few meters from the patient, will have a detailed picture of what is happening on the operating table. Currently, the world's only universal remote-controlled robotic system is the Da Vinci system from Intuitive Surgical Inc. Today, many specialists in developed countries of the world work using this technology.

Today, medical robots are changing surgical techniques, simplifying delivery and disinfection, and allowing healthcare workers to focus more on patients.

The first medical robots, introduced in the 1980s, assisted in surgical procedures using robotic arm technology. Over time, computer vision technologies powered by artificial intelligence and data analytics have transformed robots and expanded their role in many areas of healthcare.

The Da Vinci apparatus is a new generation robot that allows surgery to be performed through small incisions using miniature manipulators and high-resolution 3D cameras, which gives the surgeon the most complete image of the surgical site.

It is the only technology that provides the surgeon with the precision, dexterity and control of traditional abdominal surgery, where the operation is perormed through one to two centimeter incisions.

It is important to understand that robots do not control the operation; all aspects of surgery are controlled by the surgeon. The system cannot be programmed and cannot make decisions on its own.

Each maneuver is performed with the direct participation of the surgeon, who uses the da Vinci robot for this.

The da Vinci Robot features an ergonomic surgeon's console, a stand with four robotic arms, a high-performance InSite® vision system and patented EndoWrist® instruments.

The technology measures the surgeon's movements and converts them into instrument movements. The surgeon sitting at the console sees the surgical field, holds and moves the hands of the manipulator and performs the necessary actions.

The system seamlessly translates the surgeon's movements into device movements in real time.

The robot has four manipulators: two control instruments and fit the surgeon's right and left hands, a third manipulator controls the endoscope, and a fourth manipulator performs additional tasks. Basic movements are carried out using handles and pedals.

The da Vinci robot can be used to treat the following diseases:

• Bladder cancer
• Colorectal cancer (rectal cancer)
• Cardiac ischemia
• Endometriosis
• Cancer of the uterus, cervix and ovaries.
• Severe uterine bleeding
• kidney disease
• Kidney cancer
• Mitral valve prolapse
• Obesity
• Prostate cancer
• Laryngeal cancer
• Uterine fibroids
• Uterine prolapse

Device and software

The instruments used with the da Vinci device are the patented EndoWrist® instruments, which are designed to resemble the human wrist and have a wide range of motion.

The tools have seven degrees of freedom and the ability to bend 90 degrees. The da Vinci robot is equipped with a hand tremor suppression system, the radiation curve is shortened, and the variation of hand movements is raised to limits unattainable by the human hand. Increasing the radius of use of devices allows performing operations in limited areas (pelvis, pericardium, mediastinum), improves access and increases the reliability of surgical intervention.

The InSite® Vision system is a high-definition 3D endoscope and imaging system that allows the surgeon to see a natural image of the surgical site. Synchronizers, lighting and camera control units improve and enhance the image.

The da Vinci robot has four manipulators.

It's almost like a surgeon has four arms.

With one "hand" you can take the organ, move it back and fix it in the desired position. You can then activate another manipulator and continue working, all without an assistant.
The manipulators have 7 degrees of freedom and are able to bend in ways that a surgeon's hands cannot.

The doctor sits at a convenient control panel, which allows him to view the operated area in a three-dimensional image with multiple magnification, and uses special joysticks to control the instruments.

Using two joysticks with highly sensitive mechanisms, the surgeon gives commands to the robot at a certain speed, and "manipulator arms" with surgical instruments copy and repeat the movements of the surgeon's hands and fingers.

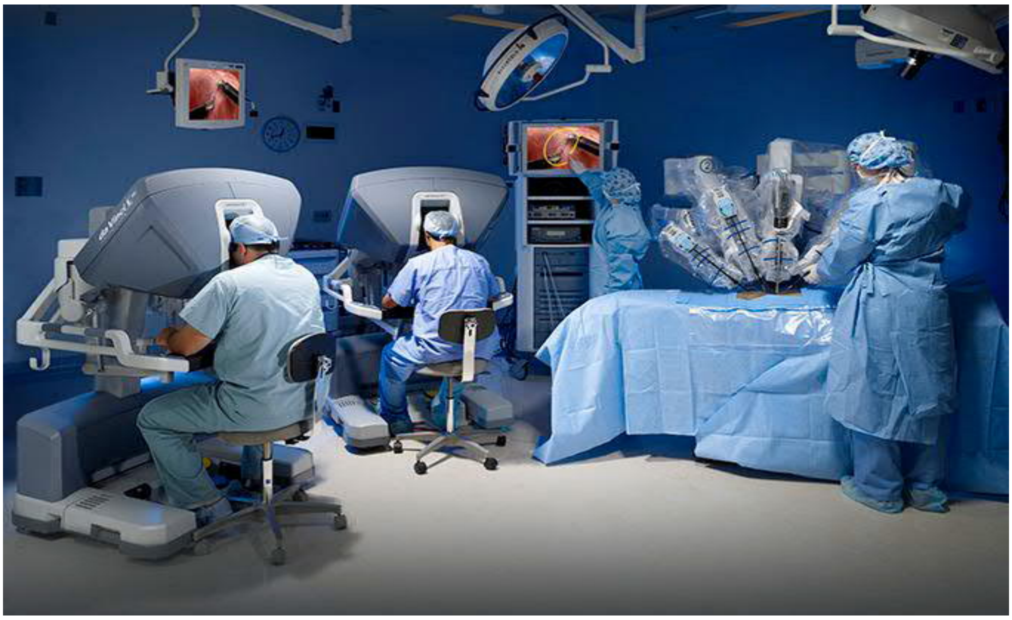
The surgeon who worked with da Vinci sees the surgical field with magnification up to 20 times and moves with precision inaccessible to the human hand. Precisely controlled microsurgical instruments can be placed 5 times more accurately than manually.

Positive aspects of using robots in medicine

Maneuverability beyond human reach.

Perfect precision of the doctor's actions.

Unrivaled Visualization



Robot programming language

A robot control metalanguage is a robot programming language that allows systems from different manufacturers to communicate effectively with each other. Or, to put it another way, "it is a programming environment in which tasks are programmed, not a robot."

It is designed to achieve the same result no matter what action the robot performs.

This allows you to create conditions for the collaboration of several robots. Used to describe the actions of a robot or group of robots.

It includes a number of visual aspects of representing code in relation to classes and objects in programming languages that implement the object-oriented programming paradigm.

Goals of RCML

1. Getting the same result no matter what the robot does.

Based on the low-level functions provided by the robot, the high-level functions required to perform a specific task can be created within the hardware and software capabilities of the robot, which are used without any modification.

2. Creating conditions for joint work of several robots.

RCML allows you to use multiple robots to perform a task, and you need to describe how a particular robot should behave in relation to the actions of another robot.

3. Significantly simplify the programming of robots, lower the barrier to entry into this area. From the low-level functionality of the robot, you can create high-level functionality.

4. Optimal selection of a robot to solve a specific problem.

RCML provides work with a group of robots of the same type and allows you to create an algorithm for selecting the most suitable robot from the group in terms of performance.

5. Switching the robot between several tasks at the same time.

When a particular robot is removed from a group during program execution, it can be released if the robot is no longer needed.

RCML syntax

The syntax of RCML is close to the programming languages C, Java and JavaScript. Syntax similarity is necessary so that programmers can easily switch between other languages.

RCML Properties

RCML is focused on robotics and has very few components as a programming language, since it is not intended for creating general-purpose application software and is focused on interacting with robotics, which allows for new results in this regard.

Robot concept in RCML

In RCML, a robot is represented as a type of executable resource that can be used to perform a specific task (function) and then released for processing.

III. Results

This method has actually proven itself very well in practice. It gives excellent results even in the most complex operations that require maximum precision, and helps patients recover very quickly and return to their normal lives, unlike conventional open surgery.

IV. Conclusion

The development of complex medical inventions, such as the da Vinci robot surgeon, and the introduction of any innovative technologies are very expensive, but the main thing is not the cost indicator, but the quality result for the patient. Doctors use it for high-quality operations for the patient, shorter recovery times after surgical interventions, less damage during surgery, less consumption of medications, and no need for repeated x-ray examinations.

Minimal complications arise when using robotics: in less than 1% of cases, wound infection or hernia formation, bowel dysfunction, damage to the bladder and urinary tract are possible. In addition, there will be less bleeding, bruising and no need for blood transfusions. And for the doctor, this is the opportunity to perform manipulations that no one has done before, reducing the time of manipulation, the fact that the hands do not tremble and move more compared to human hands. operations can be carried out remotely even from other countries.

REFERENCES

1. Наталья Дорогова. Зачем роботу «Да Винчи» четыре «руки». Сергей Собянин посетил уникальный медцентр на шоссе Энтузиастов // Восточный округ. — 2015. — № 20 (109) за 12 июня. — С. 2. Архивировано 18 июня 2015 года.
2. Железный хирург // Популярная механика. — 2010. — № 5. — С. 14.
3. Babbage Science and technology. Surgical robots: The kindness of strangers. The Economist (18 января 2012). Дата обращения: 21 февраля 2013.
4. Сырямкин В. И. Интеллектуальные робототехнические и мехатронные системы. М.: Ленинград. 2014. 188 с.
5. Абдурахманов А. И., Курбанов О. Р. Детали и механизмы роботов. Основы расчета, конструирования и технологии производства. М.: Медицина, 2014. 208 с.
6. Kalan S, Chauhan S, Coelho RF, et al. History of ro- botic surgery. J Robot Surg. 2010
7. Rustam Y. E. et al. EVALUATION OF MACHINE LEARNING ALGORITHMS FOR GASTROENTEROLOGICAL DISEASES PREDICTION //Science and Innovation. – 2023. – Т. 2. – №. 7. – С. 83-94.
8. Raxmonov E. et al. IRON DEFICIENCY ANEMIA MED ANDROID APP OPERATING TECHNOLOGY. – 2023.
9. Maxsudov V. G. et al. ORGANIZATION OF DISTANCE EDUCATION BASED ON MODULES OF MODERN PEDAGOGICAL TECHNOLOGIES //CENTRAL ASIAN JOURNAL OF EDUCATION AND COMPUTER SCIENCES (CAJECS). – 2023. – Т. 2. – №. 2. – С. 38-42.
10. Яхшибоев Р. Э., Яхшибоева Д. Э., Эрметов Э. Я. СЕНСОРЫ СЛЮНЫ ЧЕЛОВЕКА ДЛЯ ПЕРВИЧНОЙ ДИАГНОСТИКИ ЖЕЛУДОЧНО-КИШЕЧНОГО ТРАКТА //MINISTRY OF HIGHER AND SECONDARY SPECIAL EDUCATION OF THE REPUBLIC OF UZBEKISTAN MINISTRY OF HEALTHCARE TASHKENT MEDICAL ACADEMY. – 2023. – С. 205.
11. Eshmuradov D., Bahronova S. ISO SERTIFIKATLASHTIRISH XALQARO STANDARTLARINING BIR TURI SIFATIDA //Engineering problems and innovations. – 2023.

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