

Prospect and Application of Medical Robots in the Context of Epidemic

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Abstract. Under the background of the modern epidemic, where exposed the disadvantages of epidemic prevention, and the safety of health care workers cannot be guaranteed, the medical efficiency can't satisfy people's basic needs, it also cannot reasonable allocation of medical resources. The robot by its efficient characteristics will assume greater responsibility. This article based on the current domestic and international policies and forms to analyze the key technology of the current medical robot. Several types of medical assistant robot in the market are analyzed, the advantages and disadvantages of the robot are given, some suggestions for improvement are put forward, the future development prospect of the robot is analyzed and the market is prospected. Through a series of investigations and studies, it is found that the medical robot can indeed play a very good help to the medical staff, and optimize the nucleic acid process. Moreover, it can effectively protect the safety of medical staff, reduce the possibility of novel coronavirus transmission, save people's time and improve handling efficiency. However, due to the insufficient development of the Internet technology in the past, there are still some problems in these robots. In conclusion, Robots are highly efficient, need less rest time than humans and have a lower probability of making mistakes.

Keywords: Novel Coronavirus; Medical Auxiliary; Human-computer Interaction.

1. Introduction

Since the outbreak in 2020 so far, epidemic crisis still unresolved, often broke out in all parts of the country, not only that, but experts predict the outbreak will become the norm, even like influenza associated with the human. In this way, in order to meet the demands of the epidemic prevention and control, in case of a major epidemic, medical personnel need to go to various regions to ensure the collection of nucleic acids [1]. Especially in the summer they will against the hot summer, wearing sun-protective clothing, heavy a job is a long time, long work pressure cause great damage to their physical and mental, some even heat stroke were taken to a hospital, even though they have strict protective measures, but the infection rate is still higher than that of ordinary people, under this background, in order to alleviate the pressure of the medical staff, reasonable allocation of resources, better coordination of the masses so as to facilitate the development of the disease prevention and control measures, the medical robot arises at the historic moment. The robot is currently on the market have if no contact distribution robots, intelligent mechanical arm do accounting, but its accuracy needs to be improved, and almost no involved in hospital ward design, we will expand the medical robots used to whole medical system. As a result, help to improve the efficiency of doing accounting, alleviate the pressure of the medical staff [2], we combine the original robot to the market investigation, and analysis the problem to be solved and its market prospect at present, to analyze the prospect of medical robots in recent years, with its high efficiency, practicability, diversity into each work area, there will also be great prospects in the medical field.

2. Application Status

2.1 Medical Transport Robot

Back in the fight against "SARS" in 2003, Harbin Institute of Technology has developed the "isolation ward service robot", also known as "the nurse assistant robot", institute of automation, Chinese Academy of Sciences has developed the "SARS" assistant robot, used to transport medical

apparatus and instruments, experimental samples, medicine, food, for the patient treatment area garbage, etc. It can effectively reduce the direct contact between medical staff and patients [3], China News reported that two AirFace AI-powered medical service robots have been put into the fight against COVID-19. These two medical service robot was nicknamed "white", developed by Shanghai Jiaotong University team with face recognition, natural voice interaction, remote collaboration and other functions, able to complete daily rounds, giving medicine, such as tasks, effectively reduce the probability of doctor-patient cross infection and the labor intensity of medical staff in addition to this, Instead of human food delivery, Purdue's Joy Delivery robot is equipped with four-tiered trays that can deliver to four rooms at a time [4] (figure1). The twin robots "Pingping" and the robots take the initiative to complete the distribution of materials, can realize the autonomous opening and closing of doors, autonomous elevator and other functions, and also can carry out real-time image monitoring and interaction in each ward [5]. Hospital in hubei, guangdong, zhejiang and other provinces and cities, developed by Shanghai qing lang intelligent technology co., LTD. "little peanuts" robot, using a laser, infrared, sonar, such as visual sensor complete trackless run independently, can work for 24 h uninterrupted, greatly reduce the workload of medical staff, reduce the safety risk of clinical staff [6].”



(a)Xenicus sterilizes the robot

(b) Baxter help medical staff undress

Figure 1. Description of medical transport robot

2.2 Intelligent Triage Robot



(c)Cloud ginger XR-1 robot



(d) Pharyngeal swab sampling robot

Figure 2. Intelligent triage robot and Throat swab collection robot

The allocation of resources under the background of today's outbreak staff become a difficult problem, if the patient during the outbreak is more, the robot can do triage drainage of the different types of patients to the diagnosis of different departments, greatly reduce the burden of the front desk staff, reduce their contact with patients, this kind of robot is the main use of intelligent sensor technology. During the epidemic period in Wuhan, cloud ginger XR-1 robot 7 (figure2) (c) can be responsible for providing services such as welcome reception, epidemic knowledge popularization and medical health consultation. The limb movement of this robot has high flexibility, and it can perform anthropomorphic movements such as dance activities and precise grasping to help patients relieve their tension. Based on intelligent voice technology [7] and natural language understanding technology [8], intelligent triage, guidance and guidance in the hospital can be completed through voice interaction with patients [9].

2.3 Throat Swab Collection Robot

The collection of pharyngeal and nasal swabs for nucleic acid testing is an important step in the diagnosis of COVID-19 (figure2) (d). This process is very dangerous for collectors, because suspected patients need to open their mouths, virus-carrying aerosols are likely to bring the risk of infection to medical staff [10]. Using machine devices instead of manual workers can effectively avoid infection [11]. Three aspects should be considered when the robot completes the autonomous throat swab collection: (1) accurately identify and locate the throat swab collection site; (2) To achieve safe and effective contact force control; (3) Do a good job of robot disinfection protection to avoid cross infection. The new intelligent throat swab sampling robot system jointly developed by Zhong Nanshan's team and Shenyang Institute of Automation, Chinese Academy of Sciences [12]. It is composed of a snake arm, binocular endoscope, wireless transmission equipment and human-computer interaction terminal. The snake-shaped manipulator has the ability of dexterous and accurate operation, and the ability of sensing the contact force with the pharyngeal tissue. Binocular endoscope provides high-definition 3D anatomical scene. WIA-FA industrial wireless network guarantees the real-time and reliable transmission of control instructions. Besides, human-computer interaction terminal with force feedback can provides operation immersion. Through these technologies above, the robot can gently and quickly complete the task in the way of remote human-machine collaboration.

3. Problems in Existence

At present, the popularity of medical robot is too low, only exists in some big cities, cannot become the main force, and the government does not pay enough attention to promote this equipment, in terms of research and development investment, the research and development cycle of medical robot is usually very long [13]. Obtaining the research certificate from the early stage of research and development requires repeated modification and demonstration, and the investment cost is huge. The fund obtained through the national project is far from meeting the demand. One of the main reasons is that the top technology of these robots is still mastered in Europe, the United States and other countries, and the market penetration rate of China is less than 5% [14]. The mainstream medical robots in the market are almost produced by foreign enterprises, and those including intelligent robots with voice need reliable network information or they will give wrong guidance to people.

4. Outlook

The human-oriented interaction design is respected, voice control and mobile phone control are added to provide people with a more comfortable experience. Combined with the Internet of things technology, more detailed experiences such as ward booking [15] and screening are added to optimize the experience of patients during hospitalization, and the deep learning technology of robots is improved. In addition, it is more important to highlight the development of specific functions, leaving

out some components irrelevant to the core technology. In addition to the machine types listed above, there is one type of robot that have good market prospects under the background of epidemic situation. Telemedicine can effectively avoid the contact between medical staff and patients and patients in the context of the epidemic [16]. For telemedicine, cloud technology can be used to collect patient's medical records and medical conditions and share them via video. The design of medical Internet of Things is in the ascendant in China. Medical Internet of Things is the core of future smart medicine [17]. The overall framework of medical Internet of Things can be roughly divided into three parts: perception layer, platform layer and application layer, the sensing layer uses physiological signal acquisition methods such as RFID (radio frequency identification), sensors, infrared devices, two-dimensional codes, and big data to collect user information [18]. The platform layer is mainly for the transfer between the sensing layer and the application layer, the application layer makes use of the existing big data to make reasonable medical and health analysis for patients and provides individualized plans. The use of the application layer for hospitals is to realize drug management and medical device management, improve the quality of hospital care. at present, there is a real-time electrocardiogram monitoring system for remote detection of cardiovascular diseases using IOT medical [19].

5. Conclusion

From the research and investigation of robots related to epidemic prevention and control in this paper. It can be seen that medical assistant robots can really protect the safety of medical personnel, which can also improve efficiency and user experience. For example, the laryngeal swab collection robot can take samples with mild force, which can not only effectively collect samples but also avoid people's rejection of nucleic acids. The intelligent triage robot has a variety of functions, in addition to normal conversation with people, it can also tell jokes, etc. It can improve the user experience of patients while completing tasks with rich and interesting languages and functions, which can effectively relieve people's weariness and relax people's mood. The intelligent distribution robot can well relieve the pressure of personnel. In normal times, patients can have a normal conversation when they are not accompanied in the ward, and most of the needs of patients can be met through voice communication, such as medicine delivery and food delivery. In addition to being used in epidemic prevention and control, these robots can also relieve the pressure of hospital reception when there is no epidemic, such as triage robots and intelligent distribution robots, which can relieve the pressure of medical staff and reasonably allocate human resources. Besides, this paper puts forward some directions for the improvement of medical care. For example, telemedicine and medical IOT are two good directions. Due to the development of Internet technology, online medical care and remote detection and monitoring can become a good development direction. However, the research on the main technical support behind various robots in this paper is still insufficient, future research will explore the core technologies of these robots to improve their accuracy and efficiency. With the advent of the current 5G era, artificial intelligence, the increasingly advanced Internet technology, medical assistance robots are more and more respected by people, robots more or less to replace people's labor has become the trend of the time, the prospect of robots will be better and better.

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