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Application of intelligent filming equipment in medical health monitoring

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Abstract. – OBJECTIVE: With the progress of technology, a variety of video shooting equipment appeared in people's vision. The improvement of video shooting performance and the decrease in production cost have not only lowered the production threshold, but also greatly facilitated people's daily life. Especially in the field of medical health monitoring, video shooting plays an increasingly important role. This paper summarizes the application of intelligent filming equipment in medical health monitoring under this background.

MATERIALS AND METHODS: The intelligent filming equipment used in medical health monitoring is mainly applicable to patients who do not find it convenient to use contact shooting equipment, as well as patients with cardiovascular diseases and health detection and rehabilitation guidance for human knee joints. In this context, this paper uses literature survey methods and interdisciplinary research methods.

RESULTS: We conclude that the measurement results of health monitoring devices obtained by using intelligent filming devices can only be used as a reference for medical personnel in further diagnosis, failing to reach the accuracy of direct medical diagnosis.

CONCLUSIONS: The research of intelligent filming equipment in the field of medical health monitoring still needs continuous improvement. The monitoring results should be more stable and eventually industrialized, to solve the current problems in medical health monitoring. This will ultimately help to protect people's health.

Key Words:
Intelligent filming, Medicine, Health, Monitoring.

Introduction

With the advent of cloud platforms and the Internet of Things (IoT) era, intelligent medical treatment has been developed by leaps and bounds. The emergence of various intelligent shooting devices has not only brought a new visual experience, but also caused a change in the way of shooting, mainly in the increasing number of people using cell phones to shoot[1]. Although the shooting performance of cell phones is not as good as professional SLR cameras, they can already meet daily needs. Due to their portability and intelligence, cell phones have surpassed DSLR cameras as the best choice for photography. Nowadays, there are many works that use cell phones to shoot short videos and generate great repercussions, and these creators are no longer just professional photography agencies and film industry practitioners, units, and enterprises. Individuals are becoming more and more involved. Filming video work is no longer the preserve of professionals. With the enhancement of cell phone hardware and software capabilities, the use of cell phones to shoot a variety of difficult shots has become possible. Intelligent mobile shooting arm is generally applied to the field of broadcasting and television, which can replace people to complete some difficult shooting work, such as natural disaster scene shooting. It looks like a mechanical arm, which also means that it is designed to imitate the human hand and arm an intelligent device. Intelligent mobile shooting arm can complete some of the shooting needs to move back and forth left and right. In addition, the device can not only monitor the operation of the console to avoid obstacles, but its operability also has greater flexibility and fewer constraints. Since the device can be connected to a cell phone, it can be controlled and received by a cell phone. In 2018, the first domestic intelligent mobile filming system "Yika" was unveiled at the Beijing, China International Radio, Film and Television Exhibition, as shown in Figure 1. With the increasing demand for video programs, traditional filming methods need to be combined with intelligent filming methods to optimize the form and content of programs and save manpower and production resources. News, interviews, and shopping videos

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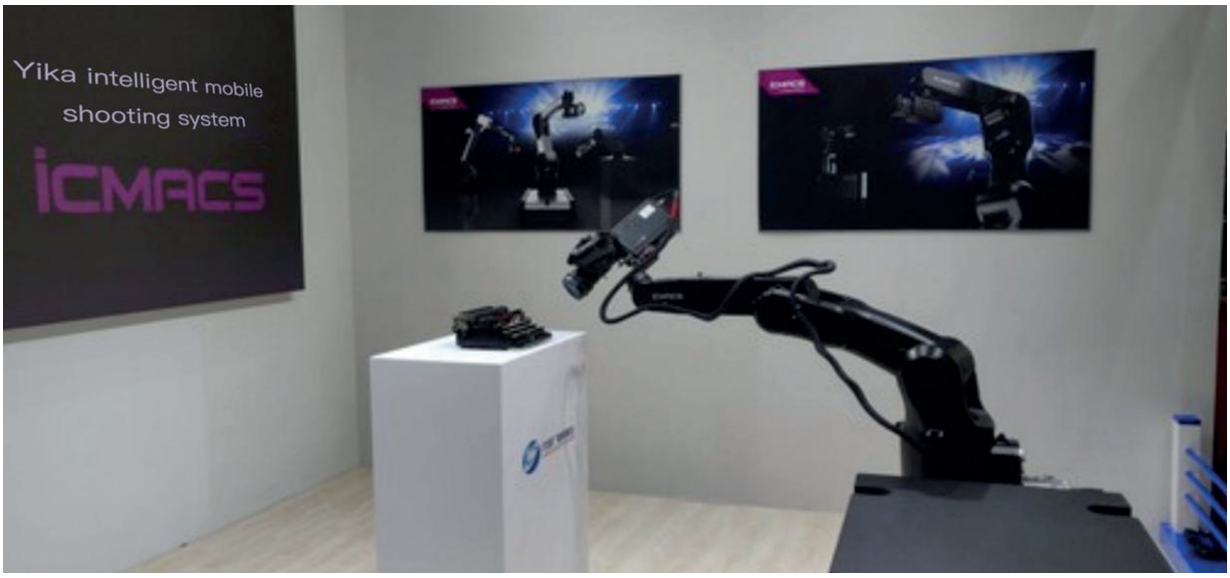

Figure 1. "Yika" system shooting display.

are usually shot indoors; in addition, the intelligent filming methods used outdoors are also applicable to sports events capable of shooting sports images of "electric rabbits" and "flying cats", referring to the high-speed track tracking camera system and ropeway camera system. Robot camera system refers to the programming and other technical means to complete the remote control of the studio camera, such as vertical, horizontal, angular movement, speed, and acceleration of the camera. In recent years, breakthroughs in new technologies for aerial photography have led to its rapid development. People have lightened the gyroscope stabilizer used for aerial photography and made it into a handheld stabilizer, which works very well. The gyro stabilizer uses internal motor operation and gyroscope calibration to work with the photographer to complete the balance of the camera. The gyroscope uses artificial intelligence AI algorithms to keep the camera stable in the horizontal axis, directional axis and pitch axis during shooting in three axes to overcome picture shaking. The anti-shake performance remains excellent even when shooting in strenuous motion scenes. The operation method is very simple. Using this handheld stabilizer, the phone can be kept level while running, jumping, upside down, tilting, rotating and other strenuous movements. In addition, due to the development of technology, the handheld stabilizer also has a built-in function inside to upload the shooting video or use the quick template to shoot video, which greatly improves the efficiency of video production and upload. The AR glasses used in the news report can turn the scene seen into a live feed, causing an immersive feeling[2].

Cell phone shooting, intelligent mobile shooting arm, studio intelligent shooting technology, handheld stabilization technology, drone aerial photography technology, and AR glasses embody increasingly mature intelligent shooting technology. Lowering the shooting threshold will also enable more and more people to participate in video shooting[3]. Currently, with changes in lifestyle and work, the ultimate result of an aging population is a decline in immune system function and an increase in the incidence of osteoporosis and spinal lesions. The high incidence of cardiovascular disease, high mortality rate and high recurrence rate, along with the difficulties in accessing medical care, low hospital efficiency and unbalanced medical resources, make the intelligence and homeliness of health monitoring products one of the factors to be considered in product design. Non-contact monitoring can monitor one's own health status anytime and anywhere and is a suitable monitoring mean for home health monitoring, as well as a method that does not change life habits, with a simple process, little pain and low cost. However, the key to realizing non-contact medical health monitoring is the accuracy of medical information; just like solving a mathematical problem, if the basic formula of the solution is wrong, then the final solution of the whole problem is also wrong. So how to collect human biological information in a comprehensive, con-

venient and accurate way is the key to ensuring the realization of intelligent medical treatment. The imaging equipment is the most important aspect of the data collection method for non-contact medical health monitoring devices. The camera becomes the main imaging equipment, and its parameters will image the quality of the captured video. This paper aims to explore the application of intelligent filming equipment in medical health monitoring, using the literature survey method and interdisciplinary research methods, and concludes that the application of intelligent filming equipment in the field of medical health monitoring still needs to be improved. Stability and accuracy of the results will also be improved at the same time, and the industrialization of the equipment will be realized eventually.

Materials and Methods

Medical Health Monitoring

Medical photography is an important part of modern medicine[4]. As in medical teaching, photography not only provides rich image materials, but also transmits knowledge more vividly and imaginatively, increasing the amount of information while improving the effectiveness of classroom teaching[5]. Medical photography is also the most objective and vivid recording method in the process of diagnosis and surgical treatment. Such as preoperative preparation, scheduled surgical plan, handling of emergencies, and the extent of patient recovery after surgery, providing information for the process of surgery and post-operative analysis and research. Medical photography is also a necessary tool for medical research and communication. Medical research provides strong supporting evidence, especially regarding the morphological structure of organs and tissues. Medical photography is also an indispensable foundation for modern medicine, as images are easy to store, less prone to damage, less expensive to maintain, and easier to access and transmit. The use of network transmission also enables the sharing of image data across locations and improves the utilization of resources. The remote transmission of image data is a good way to realize remote consultation in different places and guidance by experts in different places. In addition, the rich image data can enrich the diagnosis report and enhance the visual effect. More noteworthy is that medical photography can provide evidence for medical disputes arising from surgery. Medical photography can truly record the surgical process. Whether the surgical process is reasonable, whether there are mistakes in the process, and whether the emergency is handled properly can be truly recorded. Thus, medical photography can handle medical disputes in a fair and objective manner[6].

With the rise of the Internet, smart healthcare has seen unprecedented development, and many research institutes, universities, and companies have achieved remarkable results in human health monitoring in the field of smart healthcare. 2008 saw the development of the Health Guide device by Intel Corporation (Santa Clara, California, CA, USA) which monitors the physical condition of patients. Later Intel Corporation cooperated with General Electric Company to devote itself to telemedicine research. In December of the same year, Intel first proposed the concept of smart healthcare and provided medical solutions for customers with the concept. Cisco of the United States is dedicated to the research of wireless mobile medical care, which enables wireless medical care. IBM Corporation, Armonk, NY, USA, developed the Continua health Alliance system, which can realize remote monitoring of human health through wireless Bluetooth. The PHMON body monitoring system developed by Karlsruhe Institute of Technology in Germany can monitor human physiological information anytime and anywhere and realize the information interaction between the system device and the user through Bluetooth. There is also Apple Inc. in Cupertino (California, CA, USA) that developed a health monitoring bracelet, which can monitor human heart rate, exercise status, sleep condition through Bluetooth transmission to cell phones or the Internet. Many domestic research institutions have also made a breakthrough in the field of intelligent medical monitoring. For example, the health testing equipment developed by combining excellent medical resources through the medium of Internet of Things and cloud platform can realize the detection of human heart rate information through pulse sensor, circuit and microprocessor, and compare and analyze the monitoring results of different states and time periods of human body. Wireless communication technology developed by Southern Medical University, Guangzhou, Guangdong Province, China can monitor the quality of sleep and also allows the human pulse to be objectified on a smartphone in the form of a waveform and access the mobile communication network or the Internet for remote data transmission and sharing *via* smartphone[7].

The Application of Intelligent Filming Equipment in Medical Health Monitoring

Kinect camera-based data acquisition

The Kinect camera mainly enables the acquisition of data for monitoring the health condition of the human knee. It is a camera device launched by Microsoft in Redmond, Washington in 2009, its advantage is that it has a high-definition 2D camera, capable of taking up to 1080p high-definition pictures. The Kinect camera also has an infrared camera function that can detect the distance between objects, and this function is not disturbed by the light factor, so it can also shoot in dim environments. The Kinect camera also has a function that has a sound sensor that can accurately recognize the commands of the controller. These functions of the Kinect camera can realize the human-computer interaction in natural scenes, such as online fitting rooms, car show presentations etc. It can also recognize an object by the depth generated by the camera and reconstruct a three-dimensional image of that object, thus enabling the robot to automatically avoid obstacles. The Kinect camera can also perform face recognition on the user, and extract data from human joint points by collecting data to realize a three-dimensional display of the scene. Li et al[8] designed a health monitoring device for monitoring the health condition of human knee joints, which consists of three modules: data acquisition, data processing and result display. The design relies on Kinect camera for data acquisition, through which the health condition of knee joints can be measured and can be used in many scenarios such as family, elderly institutions, and community, which can complete the health monitoring and rehabilitation of human knee joints. The overall system diagram of the monitoring system is shown in Figure 2.

Commercial Cameras or Portable Device Cameras in Health Monitoring Based on Facial Skin Features

Heart rate and respiration rate are important indicators for measuring a person's mental and physiological state. There are two existing measurement methods: one is electrocardiography, and the other is based on remote photoelectric volumetric pulse wave tracing, also known as rPPG. rPPG is more convenient and promising because it uses a camera to collect signals at a greater distance without contact with the person being monitored and without specialized equipment. The rPPG-based physiological index measurement algorithm mainly uses the color change caused by the absorption or reflection of the skin in the captured video to infer the change of blood flow in the human body to obtain the corresponding physiological index. Due to the rapid development of society and the increasing awareness of personal health monitoring, there

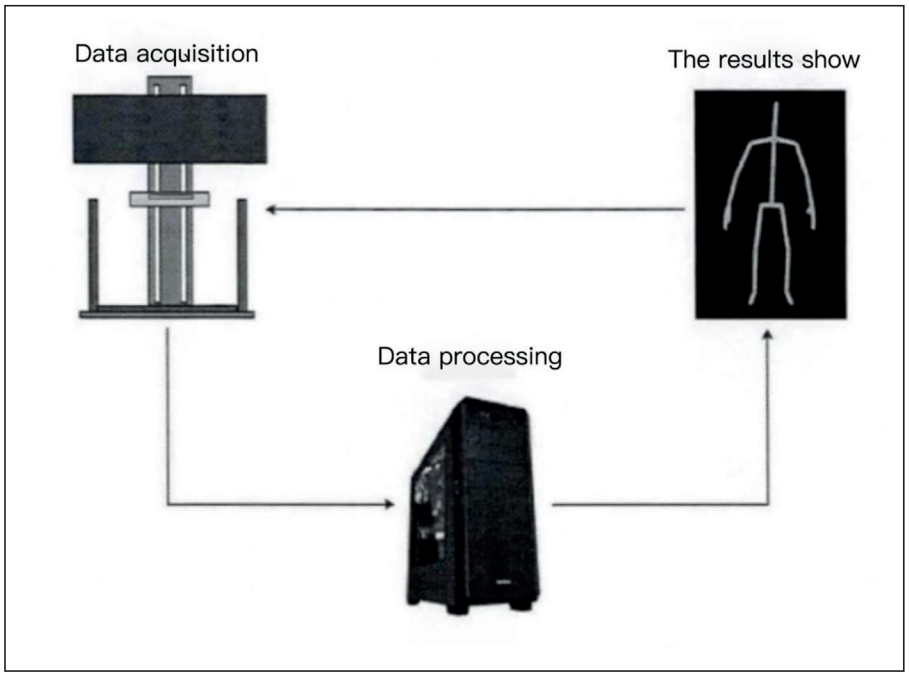

Figure 2. Diagram of human lower limb health monitoring system.

are good prospects developing various intelligent medical devices, such as the change from contact to contactless remote diagnosis. Currently, health monitoring based on rPPG technology mainly relies on the video capture function of commercial cameras. Current research has found that the rPPG technology health monitoring method based on facial skin features, which can be combined with the idea of facial diagnosis technology in Chinese medicine, can only measure heart rate as well as diagnose heart health more accurately, and for youth health is limited to acne identification. In terms of performing heart rate monitoring, a multimodal fusion method of different regions can also be adopted to extract heart rate signal waveforms for analyzing information such as blood pressure or respiration rate[9].

Monochrome Camera Based Cardiovascular Physiological Parameters Detection System

Cardiovascular diseases are a serious threat to human life and health, and the rapid and accurate detection of cardiovascular diseases is an important approach to preventing and treating cardiovascular diseases. Such as heart rate, respiration rate, blood oxygen saturation and other parameters reflecting cardiovascular physiology are used to diagnose cardiovascular diseases, but what is more important is how to measure these cardiovascular parameters accurately and conveniently. The methods currently used in clinical practice include cardiac monitors and oximeters, which are highly accurate, expensive, and complex to operate. The most significant feature of these instruments is that they require physical contact with the patient to measure, which is not useful in some cases, such as when the patient has burns. Wieringa et al[11] attempted to extract reflected light from a monochromatic COMS camera at a distance of 0.7 m from the patient's arm to calculate heart rate and respiratory rate. In addition, Kong et al[12] used natural light and a CCD camera to calculate the heart rate, respiration rate and oxygen saturation parameters of the volunteer's face. Also, Shao et al[13] used a COMS camera to calculate the blood oxygen saturation of human faces under the illumination of LED light source. The results of Fan et al[10] show that monochrome cameras in combination with imaging photoplethysmography, also known as IPPG technology, are possible for non-contact prediction of important cardiovascular parameters such as human heart rate and oxygen saturation.

Cardiovascular Parameter Detection System Based on Color Camera and Webcam

Contact monitoring devices can cause discomfort because they need to be clamped to the surface of the body for long periods of time. The home health monitoring device that uses a monochrome camera for monitoring also has the inconvenience of the arm being photographed all the time for a long time when it is used. For better promotion, it is necessary not to fix the shooting position, not to fix the shooting conditions, not fix the shooting distance, and to adapt to different light, skin color and other factors. Therefore, in daily life, it is more convenient to use cell phones, iPads, webcams, and other video capture devices for data collection. These color cameras have the advantages of high image resolution, low frame rate, low sensitivity of photosensitive elements, and are suitable for wide use in daily life. Fan et al[10] developed a color camera-based system for detecting cardiovascular physiological parameters, and the results showed good agreement with the results measured by commercial oximeters. In addition, an improved cardiovascular physiological parameter detection system under natural light conditions was developed for a webcam-based detection system, which was shown to be effective in improving the accuracy of the IPPG platform for predicting physiological parameters and has good prospects for clinical and home health monitoring applications because the platform is easy to build.

Discussion

This paper proposes the use of intelligent filming devices in medical monitoring, aiming to explore the use of video and film devices in medical monitoring using an interdisciplinary research approach. We found that video and audio devices in medical monitoring are mainly used clinically for cardiovascular, heart rate, respiratory rate and human knee health monitoring, and the main concern is whether the image quality is clear. I believe the intelligent development of medical monitoring for video equipment is still insufficient. In fact, the application of smart filming devices in medical monitoring is not enough. Still, these new functions are not used in the medical field, such as the use of intelligent AR live glasses in news reports, can see the scene into a live picture, resulting in the audience "immersive" experience. The use of drone aerial photography technology

gives people a new visual experience, forming a new way of filming change. In this way, the future of intelligent filming equipment technology will certainly become more and more mature, also due to the lowering of the threshold of filming technology will be used by more and more people. However, due to the limitation of time and scientific research conditions, some of the research work has deficiencies.

(1) When performing health monitoring based on facial skin features, if the clarity of the device is not high enough and not enough data is captured, the accuracy of the results will not be high because the captured images are not detailed enough to classify the target. This can be solved by improving the clarity of the capture device.
(2) There is no clinical experience in applying intelligent filming equipment to monitoring human health conditions, and the next step could be to conduct more in-depth research on the problem and design a more complete health monitoring system.
(3) The next step can be deeper research for the mobile device and the transfer of monitoring data to the Internet, combined with the clinical characteristics of the disease and the cloud platform, big data analysis and other technologies, adding diagnostic rules to the system to achieve automatic diagnosis of the disease. Examination data of all family members can also be saved to the cloud as an important reference for health monitoring. Once there is a significant change from historical data, it is possible to remind the person being measured to seek medical treatment in time.

Conclusions

The filming equipment used for medical health monitoring focuses on its intelligence, versatility, and ease of network transmission. Since the quality of video capture directly images the accuracy of monitoring results, there are appropriate requirements for the image resolution, frame rate, and sensitivity of the photosensitive element of the capture device. However, the requirements are not very strong for whether the filming equipment needs to move, whether it needs to shoot a farther scene, whether it needs to control the shaking, or whether the filmed video has a high artistic effect. For the development of these health monitoring devices, there is still a need for continuous improvement to make the results more stable while strengthening the accuracy of the results, increasing the applicable population and environment, and eventually realizing the industrialization of the devices.

Conflict of Interests

The Authors declare that there are no conflicts of interest.

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Informed Consent

Obtained.

Authors' Contribution

Research, S. Q. Li; Data collection, S. Q. Li; Writing-original manuscript preparation, S. Q. Li and H. Y. Li; Writing-review and editing, S. Q. Li and H. Y. Li. All authors have read and agree to the published version of this manuscript.

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