A Positioning And Tracking System For Intelligent Robot

Zhoulin Chang[a,*], Tianyu Ye[b], Zixie Lu[c], Zongying Wu[d], Hanhong Tan[e], and Fu Mo[f]

College of Mechanical and Electrical Engineering, Guangdong University of Science and Technology, Dongguan, Guangdong, China

[a]mchenliy@163.com, [b]czl_ll@163.com, [c]phzyw@sina.com, [d]tianyu826@sina.com, [e]thxcz02@163.com, [f]fuzi703@163.com

[*]corresponding author

Keywords: Positioning System; Tracking System; Intelligent Robot; Transmission Error

Abstract: In order to ensure the accuracy of reconstruction robot can meet the standard, at the same time, it can show the trend of stability and lifting. With the aid of a high precision optical positioning tracker, the scientific error analysis for the positioning accuracy of the robot system is carried out, and the error of the structural parameters and motion variables is scientifically analyzed. The positive kinematic model reflects the actual structural parameters of the robot to ensure that the accuracy of the joint transmission is more reliable. Through inverse kinematics of robot inverse kinematics, the angle is solved, thus the error compensation can be carried out gradually, and the precision of the positioning datum can be improved gradually. It is proved that the basic method mentioned above can improve the positioning accuracy of the reconstruction robot.

1. Introduction

After more than 30 years of development, the positioning and tracking system for intelligent robot has been developed in many fields, and has changed the traditional means. The positioning and tracking system for intelligent robot based on computer intelligent algorithm is developed with the development of big data era and Internet information technology era. It has strong epochal characteristics and can also enhance the intelligent and autonomous development direction of robots. The combination of robot fixed tracking system and computer intelligent algorithm can open up a background management platform for robot work, which is a new revolution for tracking investigation.

Actuators are required by mechatronic products such as various optical instruments, intelligent control appliances, automated office equipment, vehicle intelligent electronic equipment, industrial robots, precision CNC machine tools, automatic production lines and automated building safety systems to drive the system up and running. For example, the rotation of the precision CNC machine tool spindle, various movements of the industrial robot control arm, such as grabbing, steering, rotation, grip, and the feed motion of the spindle table in machining center.

2. Methods

2.1. Absolute Positioning Accuracy Analysis of Robot

According to the basic operation process of the reconstruction, the coordinate system of the dobby robot is considered as the reference. It can be seen that there are two factors affecting the absolute positioning accuracy. First of all, the mapping error of the target point is the three-dimensional model image coordinate system used by the pre operation planning. The specific reflection shows the coordinate error of Dobby robot. Secondly, the error of the dobby robot is mainly determined by the robot according to the relevant instructions to ensure a reasonable error through specific pose.

The robot works in a complex environment. In order to plan the path, the obstacle must be

separated from the background. Due to the large amount of image calculation required, the real-time performance of the system is poor. In order to solve this problem, the part with large amount of calculation and mature algorithm can be put into DSP to improve the real-time processing speed. In addition, efforts are made to seek new methods of image expression and interpretation, and the algorithm is fast and effective in image processing and recognition software design.

The background image is affected by lighting conditions, image noise, acquisition angle, distance and other factors, most of the objects in the image lose the detailed contour features, and the edges are not ideal, only more texture features are presented on the macro level; at the same time, the object contour is almost submerged in all kinds of noise. If we only focus on the edge extraction by traditional differential operation, it will be difficult to obtain satisfactory results due to the relative lack of information. However, because of the existence of the edge, the texture of the local area containing the edge will change greatly compared with the texture containing the region. Based on this phenomenon, the texture analysis method can be applied to find different regional routes from the texture differences.

2.2. Specific Scheme for Target Mapping Error Analysis and Reduction

In the whole system, four coordinate systems are covered. One is the reconstruction of the model, the other is the dobby robot space and the optical navigation and positioning space. It is usually necessary to clarify the specific planning information and solve the problem by mapping the coordinates of the image to the coordinate system of the multi arm robot. In order to improve the absolute positioning accuracy of the system, we should attach great importance to different aspects, such as the three-dimensional reconstruction of the model, the registration of the model in the operation process, the transformation of the image coordinate and the transformation of the robot coordinate. The reasonable utilization of layer thickness to realize the acquisition of multi-modal two-dimensional images and the effective fusion of corresponding data is also very critical. Therefore, proper optimization of the preprocessing process of the fault image is needed to ensure the completion of the corresponding detail processing.

In addition, wavelet transform, a modern mathematical analysis method, is represented by the multi-resolution of the signal, which has good time-frequency localization analysis characteristics. It can give the time-domain and frequency-domain information of the image signal at the same time, and provide a quantitative description of the characteristics of different structure boundaries of the image. Therefore, it can effectively detect and locate various edges of the farmland image. In recent years, it has been widely used in image processing and pattern recognition.

2.3. Correction of D-H Parameters of Robot

Because of the error in the process of the parts and the influence of the robot assembly error, the proper use of the D-H method to get the result of the robot kinematics model can not accurately reflect the specific motion of the robot. This study mainly regards the middle arm of the dobby robot as an important example, and uses a method of correcting the kinematic model of the robot to compensate for the error of the parameters properly, improving the basic precision of the robot's positioning. If the use of different arms, the robot's middle arm in the middle of the robot will match the corresponding position ball hole in the specific process of the specific test, and the target ball can be fixed in time on the first joint of the robot and record the current target position.

At the time of the two joint, that is, when the arm rotates 10 degrees, the other joints remain inactive, and the coordinates of the position of the target ball in the navigation locator are recorded in a timely manner, and the center is fitted. The fixed position of the target ball is adjusted properly, then the different center of the circle will be obtained after fitting by the repeated action above, and the different center points are connected together, thus an approximate straight line appears. After the rest of the joint in the state of movement, the robot is controlled back to the original basic position. When the small arm rotates 10 degrees, the specific ball position of the small arm goes down in detail, and picks up the center.

Through the basic steps described above, the large arm and the small arm and the axis of the fourth joint are located after the detailed analysis. When the robot operates to reach third joints

alone, the actual distance and angle algorithm of the space line is used to ensure that the modified arm parameters of the large arm and the small arm are obtained in a more timely manner.

2.4. The Transmission Error Analysis and Compensation for Robot

Because of the transmission error, the motor code reading will not be able to record the movement process of robot joints more accurately. The focus is to use the adaptive search algorithm to compensate for the existing error, and to improve the accuracy of the absolute positioning, which can ensure that the data training samples in each link are effectively obtained. The joints of the robot need to be effectively controlled and the joint position is above the zero position, and then the joint is properly controlled so that the joint is still moving in the positive direction in accordance with the length of the 10 degree step. The optical navigation locator can be used when the corresponding motion is over. When measuring the movement of the joints in the specific angle, if the joint movement reaches the positive limit position, the position at the moment will prevail. After the joint is back to zero position, the joint is still controlled to move to the position of 10 degrees in the negative direction. After the end of the movement, the optical navigation locator is used to measure the concrete angle of the joint in time and effectively, when the joint reaches the negative limit. The forward motion and negative motion sample data of each joint obtained by this way are more reliable. Before training, the reasonable transformation of the scale is completed for the sample data. The data can be effectively dropped into the (0, 1) interval, and the appropriate input expectation is completed after the corresponding training is completed. And the corresponding direction of motion can be input, so that the target rotation angle of the motor can be effectively obtained.

3. Results

Appropriate method to improve the robustness of registration algorithm, rational use of space registration optimization calculation means, using four or more punctuation procedures to implement the experiment, the error of the existence of each marking point of the appropriate statistics, analysis of the distribution of errors, registration of the target registration error in a reasonable registration We should reasonably reduce the random dynamic errors and so on.

Combining with the relevant factors affecting the absolute positioning of the robot at the present stage, the analysis of the remaining errors in accordance with the basic length of the rod and the angle of the space, this study focuses on the analysis of the construction process of the robot for the reconstruction, and the relative scientific modified kinematics model can be used to show the basic kinematics of a robot. The rational and effective correction of the robot motion model makes the transmission of the robot joint and the corresponding zero position error can be effectively compensated. The aim is to ensure the improvement of the absolute positioning accuracy.

4. Conclusion

To strengthen the software and hardware of the robot positioning and tracking system, we should first improve the hardware facilities, improve the external hardware environment of the robot positioning and tracking system, and strengthen the hardware update and supervision. Non professionals can not replace or touch the hardware of the robot positioning and tracking system without permission. In order to improve the effective management of hardware facilities, the organization can manage and backup the hard disk in the hardware to ensure the authenticity and integrity of data and avoid data loss after hardware damage. Secondly, strengthen the development and use of software, according to the national requirements and the latest robot positioning and tracking system software facilities, enrich the robot positioning and tracking system software facilities, avoid software operation errors or low security caused by data loss and other illegal elements of the robot positioning and tracking system vulnerability damage. In addition, the introduction of software and hardware of robot positioning and tracking system is affected by the existing technology in China, and the development degree of mechanism in robot positioning and

tracking system is not high. Therefore, it is suggested that the organization can import relevant software and hardware facilities of robot positioning and tracking system from abroad, so as to optimize the internal robot positioning and tracking system, and realize robot positioning and tracking as soon as possible The system helps a lot.

Acknowledgements

This work was financially supported by the follow projects. The special innovation projects of ordinary universities in Guangdong Province, Project name: Research on visual recognition and sorting robots based on deep learning, Project No.: 2018KTSCX260; Project name: Research on intelligent garbage sorting robot based on vision recognition technology, Project No.: 2019KTSCX252. Project of Guangdong University of science and technology, Project name: Research on sorting robot based on visual recognition technology, Project No.: GKY-2019KYYB-7. Project of cooperation education with production China Ministry of education, Project name: Application Research of intelligent robot vision recognition technology, Project No.: 201901019029. Project of educational science planning of Guangdong Province in China: Research on the construction of intelligent robot college in Guangdong, Hong Kong and Macao. Project No.:2020WQYB014. The project of college student's Innovation and entrepreneurship training of Guangdong University of Science and Technology, Project name: Application Research of intelligent robot vision recognition technology, Project No.: S202013719007.

References

[1] L. R. García Carrillo, Rondon E, and Sanchez A.(2011) Stabilization and Trajectory Tracking of a Quad-Rotor Using Vision. Journal of Intelligent & Robotic Systems, 61, 103-118.

[2] Ahmed, Wasif, and Reza. (2011)Tracking via Square Grid of RFID Reader Positioning and Diffusion Algorithm. Wireless Personal Communications, 22, 55-62.

[3] Omari A, Ming A, and Limam G. (2019)Development of a High Precision Mounting Robot with Fine Motion Mechanism. Journal of the Japan Society for Precision Engineering, 67, 1101-1107.

[4] Wang S, Singh D, and Lau D. (2016)Probe Tracking and Its Application in Automatic Acquisition Using a Trans-Esophageal Ultrasound Robot, 16, 88-97.

[5] Bell M A L, Sen H T, and Iordachita I. (2014)In vivo reproducibility of robotic probe placement for a novel ultrasound-guided radiation therapy system. Journal of Medical Imaging & Radiation ences, 1, 311-324.

[6] Baranski P and Strumillo P. (2012)Enhancing Positioning Accuracy in Urban Terrain by Fusing Data from a GPS Receiver, Inertial Sensors, Stereo-Camera and Digital Maps for Pedestrian Navigation. Sensors, 12, 6764-6801.

[7] Samperio R, Hu H, and Martin F. (2008)A hybrid approach to fast and accurate localization for legged robots. Robotica, 26, 817-830.

[8]Cesetti A, Frontoni E, and Mancini A. (2011)A Visual Global Positioning System for Unmanned Aerial Vehicles Used in Photogrammetric Applications. Journal of Intelligent and Robotic Systems, 61, 157-168.

[9]Dan Y, Bin X, and Kaiyou R. (2018)Passive Infrared (PIR)-Based Indoor Position Tracking for Smart Homes Using Accessibility Maps and A-Star Algorithm. Sensors, 18, 332-345.

[10]Kleiner A, and Dornhege C. (2011)Mapping for the Support of First Responders in Critical Domains. Journal of Intelligent & Robotic Systems, 64, 7-31.