

Design of automatic handrail sterilizer under epidemic prevention and control

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Abstract

Objective: In order to solve the problems of traditional manual disinfection, time-consuming and labor-intensive, frequent sterilization and disinfection difficulties, and incomplete disinfection of stair handrails, the innovative design of stair handrail disinfection products is carried out. Methods: The existing disinfection methods of public areas were investigated and analyzed, and according to the sterilization and bacteriostatic effect of different disinfectants, a handrail disinfectant was designed to solve the main problems at present. Result: After regular disinfection of the handrail, the amount of germs contained in the disease was controlled within a certain range. Conclusion: Through the design and use of this product, it can effectively solve the problems of high disinfection cost and incomplete disinfection.

Keywords: common areas, disinfection, handrails, epidemic

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I. introduction

Since the outbreak of the new crown epidemic in 2020, the disinfection of public places should not be underestimated, in addition to controlling direct contact, indirect contact control has also received more and more attention, including the disinfection of stair handrails. At present, the disinfection of handrails is also mainly used in the form of manual disinfection, through spraying or wiping with a damp cloth, according to our investigation and understanding, this disinfection method seriously wastes manpower and material resources. So we decided to design a sterilizer to solve the above problems.

II. Overall system design

The automatic handrail sterilizer designed by this project is mainly composed of STM32F1 series chips and Cortex-M3 series core chips, with LD3320 speech recognition module, ZigBee communication module, ultrasonic module, voice transmission module temperature detection module, human body temperature measurement module, fingerprint recognition module and RFID module, through the infrared sensor to adjust the duty cycle of the motor and other parameters The robot can move along the specified path. The surrounding environment is disinfected by spray disinfection device during the movement, and at the same time, through the timing processor, CIC communication protocol SPI communication protocol, I/O port, uplink, serial port, etc.

III. System hardware design

The main components of the system hardware are: motor drive system, steering system, AI system, operating system, clamping module, disinfection device module.

2.1 Motor drive system

In order to achieve the purpose of disinfection and epidemic prevention robots can work normally and stably in various working modes, the mainstream power supply mode of the lithium battery industry is to use lithium batteries, lithium batteries have the design of internal step-down circuits, so that the battery voltage drops to the voltage required by each module, providing power, which not only ensures the long-term work of the chip, but also facilitates maintenance and replacement.

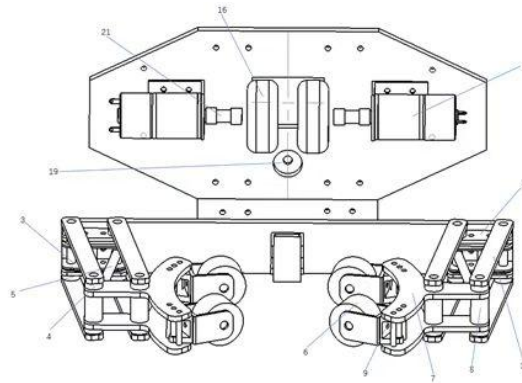


Fig.1 Overall model diagram

2.2 Steering system

By referring to the bogie structure and body structure of the train, using the bogie structure, it is possible to complete a turn of the disinfection robot in a place where it is difficult to turn, such as a guardrail at a 90-degree angle, and complete the direction adjustment of the front to the rear of the disinfection robot.

2.3 AI system

Infrared sensors are used to achieve detection of the surrounding environment, so as not to cause accidental injuries when someone is around. At the same time, it is equipped with an ultrasonic module to achieve a grasp of the distance during the movement and achieve smooth movement.

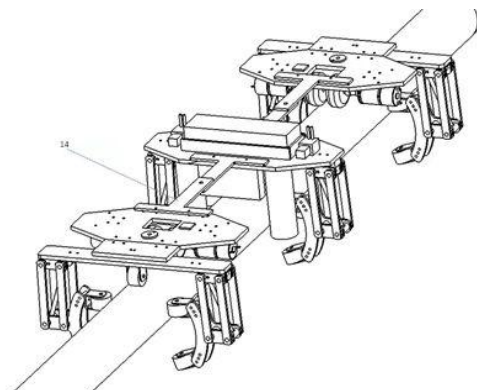


Fig.2 Gripper structure

2.4 Manipulation system

AS608 fingerprint module to achieve the robot's intelligent security function, can accurately and efficiently obtain image information, and the collected information feedback to the fingerprint recognition chip algorithm, complete the information collection In addition, the use of LD3320 speech recognition module and ZigBee communication module to control the robot, at the same time, because the distance between the LD3320 speech recognition module and the robot is limited, the user can send instructions to the robot through LD3320.

2.5 Clamping module

Connection spring and the upper part of the sterilizer wedge plate connection, to achieve a strong match between the sterilizer handle and the guardrail, due to the nature of the spring, there is still a certain degree of resilience when clamping, so the present invention has the present invention can adapt to different types of guardrails, at the turning point and the straight line intersection can be better transmission, will not damage the clamping effect.

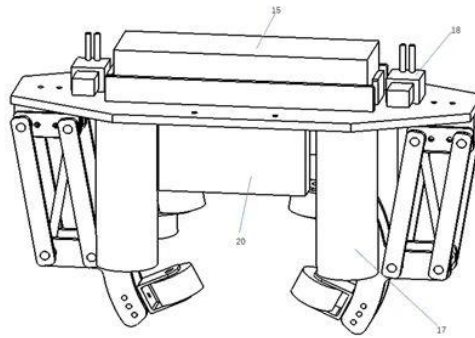


Fig.3 Snap structure

2.6 Disinfection device module

Fog nozzle, motor, small water pump and power supply connection, single-chip microcomputer control the operation of the motor, set the use time, drive the two drive wheels forward, and then the disinfection nozzle spray liquid flow forward, the application of the atomization nozzle is similar to the nozzle, can achieve a full range of killing treatment of the guardrail.

IV. System software design

This project takes C language as the main compilation language, Cortex-M3 series microprocessor can develop applications in the C language environment, the program adopts modular programming, different modules in different C files, only the communication process is implemented in the main C file, and different files are implemented by calling the corresponding functions. The biggest benefit of modular programming is that the programming structure is clearer and the program is more intuitive. More obviously, for the debugging of program modules, as well as the modification of programs, it is also very convenient, easy to read and learn. After the control chip starts, each module is initialized, the robot receives the fingerprint after debugging, the user can obtain the control information, if the robot does not get the correct fingerprint, then return the input fingerprint link until the correct fingerprint is received. Collect the information that needs to be sprayed with disinfectant, and then enter the automatic spray disinfectant function, if the information of spraying disinfectant is not received, then enter the human body temperature detection link until the instructions of the need to spray disinfectant when entering the human body temperature detection step, if the STM32 core control board receives the human body temperature transmitted by the temperature sensor, then, the voice playback module controls to read the received data, if the human body temperature is sent again or the temperature of the abnormal area is not received, a warning is issued to the user to re-measure the temperature, When the robot moves normally, the disinfection operation is carried out independently, if the main control board does not receive data from the left and right infrared sensors and ultrasonic modules, the intelligent disinfection and epidemic prevention robot does not change at the same speed.

V. CONCLUSION

After completing the design of the intelligent disinfection and epidemic prevention robot, the robot moves autonomously in the simulated environment, realizing functions such as obstacle avoidance, spraying disinfectant, voice control, temperature measurement and voice transmission. By integrating different sensor modules, fingerprint lock modules, ZigBee communication modules, disinfection spraying devices, disinfection control modules, etc., the automatic control of the robot is realized. The epidemic prevention robot designed in this project can realize the autonomous movement function, safety function, human body temperature measurement function and disinfectant spraying function, and at the same time, during the test process, the robot runs smoothly, safely and reliably. The operation is simple, can correctly complete the functions in the simulated environment, has a strong practicality, therefore, intelligent disinfection and epidemic prevention robot has a certain practical value, can reduce the burden of maintenance personnel. According to market demand, compared with manual spray disinfectors, intelligent disinfection and epidemic prevention robots have the following advantages: 1. Compared with traditional disinfection robots, the existing disinfection robots on the market can only complete disinfection work in fixed locations, fixed locations and fixed times. The utility model has the advantages of large size, good quality, high cost and single function, which can effectively reduce the labor intensity of epidemic prevention personnel, and is convenient to use and time-saving. The utility model has the advantages of high strength, long service life, complete functions, good stability, strong operability, poor dependence on manual labor, independent work after working mode, no need for manual monitoring and so

on. This topic to epidemic prevention control as the background of the times, for the public place killing problem, put forward an intelligent disinfection and epidemic prevention robot, the design of the robot has a certain practical value, but the function is incomplete, the design itself has a wider range of applications, can not only be designed according to the epidemiological situation, but also can be applied to the farm, food industry and other production lines, but this design can not completely replace the application of artificial labor in the actual working environment, I hope to do further development and update in future research, Make the robot better serve in practical applications.

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