# Intelligent Robot Safety Control System Based on MFC

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## ABSTRACT
At present, the control of intelligent robots is too simple, and the control process of the robot is insecure. We put forward a set of MFC host control system for safe operation of the robot. The system is in the form of the combination of the host computer and the lower computer.In the host computer process, the system verifies the operator face quality and dedication analysis, and then turns off the right to open the command to forward data, through the command to achieve the control of the robot. We used MFC-based control to increase the interaction of the operator to the robot. Experiments shows that the MFC security control system has a high stability, and can be easy to control the movement of the robot at the same time to achieve the safety of the robot.

## CCS Concepts
**Computer systems organization → Robotic control**

## Keywords
Mobile Robot Control; MFC; host computer; safely control

## 1. INTRODUCTION
With the continuous development of scientific research, artificial intelligence, the topic of things more and more people are more attention, China's demand for service robots is also increasing. The development of service robots at home and abroad is very rapid, in the home entertainment, family services[1], to accompany the elderly children are of great significance, become an indispensable part of human life[2]. But the existing intelligent robot has a simple interactive process, the control method is not flexible. Therefore, this article through MFC to establish a strong interactive control system[3~4], the user can use MFC program[5~6], in the interface of the phone or computer terminal by clicking the button to inform the intelligent robot to perform the corresponding action.MFC, Microsoft Foundation Classes, encapsulates the Windows API in the form of a C ++ class and includes an application framework to reduce the workload of the application developer.

In addition, the safety of intelligent robots has always been easy to overlook the part of the robot easy to identify the identity of the operator can not be manipulated, or be destroyed. Its safety certification process in the robot application there is a high necessity and importance [7]. This article through the MFC to open the implementation of face quality detection algorithm, store the operator photos, open or close the corresponding permissions to protect the robot during the use of security [8], reduce the illegal operation of the user does not occur[9].

The structure of the robot system is relatively complex and clear. The framework logic is hierarchical, and the framework of the robot framework is independent of each other and the layers and layers can be coordinated with each other, which can be easily developed. And assembly, reducing the robot development cycle and cost, the control process is stable and reliable easy to understand.

## 2. FRAMEWORK AND PROCESS DESIGN OF MFC ROBOT CONTROL SYSTEM
### 2.1 Robot Control System Frame Design
Combined with the system design function requirements system stability, specially designed as follows home robot safety verification system system architecture, the architecture design of the three layers, namely the control layer, transport layer, drive layer, layer and layer information exchange between each other closely The The hierarchical structure shown in Figure 1.


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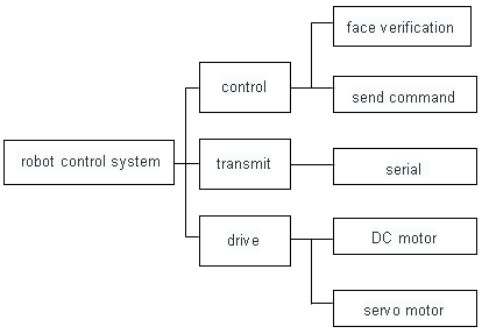


**Figure 1. The Overall Framework of The Robot Control System.**

The control layer: the host computer, the robot control system through the MFC machine and the operator to establish interaction with the operator to obtain and analyze the operator's facial features, if verified correctly, that is, open the intelligent robot operation control button, the operator through the button to send motion commands to the robot.

Transport layer: intelligent robot control system, through the USB serial port, based on serial communication technology to remotely transmit command signal.

Driver layer: the lower computer, intelligent robot system to capture the underlying control system command, through the switch and case language to judge the command, and ultimately converted into output voltage control DC gear motor and servo steering gear movement.

## 2.2 Robot Control System Process Design

Combined with the overall design of the whole family robot safety verification system, the overall process of the system analysis and design. The main process of intelligent robot control system is divided into three parts, face safety authentication, remote behavior control, robot action.

Face safety authentication, based on Open CV technology, the robot through the realization of OpenCV method, the camera binding operation, read the camera data, facial face data acquisition, analysis of facial quality is blocked, etc., if no block, then Verification is passed and the operator's facial features are saved.

Remote behavior control, based on USB serial communication technology, the robot through the USB serial port to RS232, then turn TTL, and ultimately realize the remote communication with the robot, by sending commands to control the robot action.

Robot action, through the use of DC gear motor, combined with the motor drive circuit, control Arduino controller IO switching voltage, control the motor steering, to achieve robot movement. Through the use of steering gear, control Arduino call servo function to achieve a certain degree of rotation of the robot body rotation control, to achieve robot action.

From the home robot safety verification system began to design, to Open CV read camera, analysis of facial features, serial command to send to the robot behavior control, the complete design of the system as a whole process, the specific control process shown in Figure 2.

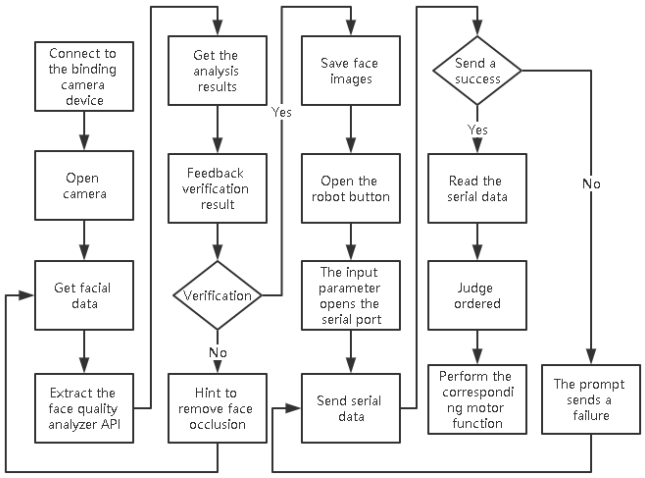


**Figure 2. The Control Flow of The Robot System.**

As shown above, the system process is divided into the following parts: Open CV binding camera equipment, read the camera face face data; extract the face quality API, enter the face data, output feedback results; verify through, open the home robot operation Function button; user input serial number, connect the device, send the robot control command; robot read command, judge the analysis command, and the corresponding movement.

# 3. MFC CONTROL TERMINAL

## 3.1 Operator Image Acquisition

Based on the use of Open CV 3.10 class library, by referencing Open CV internal functions, connect the camera device, bind the camera, set the timer, read the camera data and real-time camera data displayed in the MFC project panel under the image control.

First find the IMG image control, get the control handle, connect the context, determine whether the current camera is occupied, connect the binding camera to determine whether the camera data capture is empty, that is, determine whether the device is connected successfully, and then capture the camera image, set the image channel 3, set the image to RGB format, set the timer to work, set the timer to work two modes, that is, 1ms event 1, 5S an event two, the event one to continue to capture a picture, set the image channel, save the image, Two into the face quality verification function.

Which cited the Open CV class library, Open CV library on the computer vision of some of the relevant functions were encapsulated, by calling Open CV function can be convenient and efficient on the image, camera equipment to operate.

## 3.2 Face Quality Analysis

In the last process, the use of Open CV technology to open the camera, read out the camera picture, and the picture real-time rendering of the MFC's Picture control, while the image was saved locally, the next camera to save the image as Input, input to the face quality analyzer for analysis. The system by reading the face quality analyzer DLL dynamic library files, incoming parameters, the release of API interface, the image of the file analysis, resulting in image analysis feedback results.

By loading the human face quality analyzer library DLL dynamic library, export function to obtain API interface file, through the API interface to finally release the API, get the face quality analyzer, the file into the file analysis, get the face quality analyzer The results of the analysis of the results of the results of