

# *Unmanned Boat Control System based on Gesture Interaction Technology*

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**Abstract:** This system is the secondary development of the unmanned boat and the motion sensing controller Leap Motion. It connects the unmanned boat and Leap Motion in some ways to achieve the use of Leap Motion technology to control the unmanned boat to operate at sea or under the sea. The system uses Leap Motion binocular sensors to collect the data to be operated, and the computer uses MATLAB software to design algorithms to process the received data, convert these data into electrical signals that can be recognized by the unmanned boat, and then send these electrical signals to the wireless module NFR24L01. The unmanned boat terminal decodes the signal converted by the wireless module NFR24L01 with Arduino, and outputs the corresponding PWM wave to control the actions of the unmanned boat.

## 1. Introduction

### 1.1 Research status of gesture interaction

At present, somatosensory interaction technologies such as touch interaction and gesture interaction are expanding from the field of game consoles to mobile phones, tablets, PCs, wearable devices and other fields. For example, HP has integrated Leap Motion's somatosensory technology into notebooks; Apple has acquired Prime Sense, and integrate it into TV, PC, tablet or mobile phone. In the foreseeable future, somatosensory interaction technology with touch interaction and gesture interaction technology as the mainstream will become a standard component of electronic products. Therefore, the standardization direction of touch interaction and gesture interaction technology will support and lead the development of touch interaction and gesture interaction technology. At present, relevant international and domestic standardization organizations have carried out the development of standards for touch interaction and gesture interaction, but each organization has its own focus due to the different scope of their own work. [1]

## 1.2 Development background of unmanned boats

Unmanned boats have multiple characteristics such as portability, concealment, and intelligence, and play a great role in military, civil, commercial and other aspects. During World War II, surface unmanned boats have been put into use and completed their missions well during the period. Western developed countries headed by the United States have long been listed as key research and development targets. In 2001, the United States ONR formally proposed the concept of building a littoral combat ship and clearly proposed the surface high-speed unmanned boat. In 2007, the U.S. Navy issued the "Unmanned Boat Owner Program", planning the future development of unmanned boats. Domestic unmanned boats are still in their infancy, and many technologies are still blank, and key technologies are far away. Among them, the operation of unmanned boats is not as good as that of developed countries. At present, the domestic unmanned boat industry is still in a state of imperfect competition, and the application fields are relatively narrow. The application in many fields is still in the stage of exploration and experimentation.

## 2. Technical Principle

### 2.1 Gesture recognition

The system mainly uses Leap Motion's binocular sensors for gesture recognition data. Leap Motion's tracking target is the description of hand information, which can directly calculate the position of fingertips, joints, etc. and the direction vector and method of the palm. Vector information, and then use Qt to write the host computer interface, display the recognized gesture data, and then customize the processed data. [2]

### 2.2 Data transmission

Using MATLAB software to design an algorithm, convert the obtained data code into the electrical signal of the unmanned boat corresponding to the gesture, and forward the signal to NRF24L01 for wireless transmission. At the same time, the unmanned boat receives the NRF24L01 signal in real time and performs the received signal. Deal with.

### 2.3 Unmanned boat handling part

The unmanned boat navigation control system is the core of the unmanned boat, used to realize remote control or autonomous navigation. Including shipboard navigation control system and command and navigation control system. The shipboard navigation control system is on the unmanned boat to execute the command and navigation control system commands. The command and navigation control system is responsible for issuing navigation control instructions. The unmanned boat uses Arduino to decode the received data, then processes the data, and outputs PWM waves to the unmanned boat's onboard navigation control system, so as to realize the control of the unmanned boat's navigation status. In the process of unmanned boat processing, the most important thing is the signal processing process of Arduino and the sending process of PWM wave. Among them, PWM is pulse width modulation, that is, the pulse waveform with variable duty cycle. Duty cycle refers to the percentage of the entire signal cycle when the signal is at a high level in a period. Pulse width modulation is a kind of analog a method of digitally encoding the signal level. Through the use of high-resolution counters, the duty cycle of the square wave is modulated to encode the level of a specific analog signal. PWM is still a number, but it can be recognized by the navigation control system as a signal, so as to achieve the purpose of controlling the navigation of the unmanned

boat. The decoding process of Arduino is more complicated. [3] [4] [5]

### 3. Conclusion and Outlook

#### 3.1 Conclusion

Combine the Hand rive gesture interactive instrument with the unmanned boat. The gesture video data transmitted by the Hand rive is analyzed by the algorithm to get the model and movement of the hand, and the user's hand movement is programmed into the control command of the drone, instead of Mechanized control to control the navigation of the unmanned boat. At the same time, the Leap Motion controller is combined with the unmanned boat to enable the unmanned boat to accurately recognize gestures and increase its practicability, forming a test development version and test of the unmanned boat navigation control system based on the gesture interactive instrument Version.

#### 3.2 Outlook

In the future, it can be widely used in life, enabling gestures to control unmanned boats recklessly and applying them in reality. The more mature applications of military unmanned boats include unmanned surface craft for maritime safety and ISR and induction minesweeping unmanned boats. In the civil field, unmanned surface craft are mainly used in research fields such as the petroleum industry, natural gas industry, universities and laboratories, for coastal surveying and mapping, marine environmental monitoring, marine meteorological forecasting, marine biological research, communication relay, and marine resource exploration And development, territorial sea surveillance, etc.

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