Development of intelligent remote control walking fish robot

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Abstract. The design is based on mobile phone platform, with communication technology, design a solution for wireless remote control fish robot. According to the cage mechanism, Arduino control technology and mobile phone APP development technology of bluetooth communication realize the real-time control of the direction of the robot and remote feeding function. The interaction of toy, human and nature not only provides a new idea for the design of remote control ship, but also provides a new direction for the development of remote control toys.

1. Introduction
Since the reform and opening up, China's industry and national economy have developed rapidly. With the deepening of the industrialization process, people's life rhythm is also faster and faster. Therefore, people's leisure time is often compressed, and many opportunities for close contact with nature are lost.

The walking fish robot is a toy suitable for playing in the park lake. It uses food to seduce the fish. Users can plan the path they want through the APP remote robot. The fish chasing the robot and leaving the robot path, thus increase the robot path. Have fun watching the lake. People enter the nature while teasing, and realize the interaction with nature. Through the popular leisure and entertainment way of watching the fish, it can relax to relieve the pressure of work and life, and then achieve the purpose of regulating body and mind and self-cultivation [1].

2. Overall scheme design of walking fish robot
This design uses bluetooth communication, because the transmission effect of bluetooth is stable. The robot is mainly composed of power module, Arduino control module, motor drive module, Bluetooth HC-06 communication module and mobile phone APP module. The work flow is as follows: mobile APP communicates with the HC-06 module of the robot through Bluetooth, sends instructions to the Arduino module in real time, and the Arduino module controls the motor module according to the instructions to realize the real-time control of the robot. The overall design block diagram of the system is shown in Fig. 1.
3. **Structural design**

3.1. **Design of Driving and Driving Mechanism**

As shown in Fig. 2, the robot is driven by a DC motor. From the diagram, it can be seen that the output torque and speed of the motor are transmitted to the output shaft after deceleration by a decelerating gear, and then to the transmission shaft through a universal joint to drive the propeller to rotate and push the water out\[2,3\]. The reaction force of water is applied to propel the robot forward. In this design, a dual-drive design is adopted. The differential turning and head-turning of the robot are realized by the different rotational speeds of the left and right propellers. The DC motor of model 130 is selected as the motor, which is economical and economical and meets the following conditions.

The formulas for designing and calculating the driving mechanism are as follows:

Torque calculation of reducer:

\[
T=9550*P/n*\eta*u
\]

\[
=9550*(0.75*10^{-3})/16000*0.9*20=0.0089 \text{ N.M}
\]

Speed of transmission shaft:

\[
n_2=n/u*\eta=14500/20=725 \text{ r/min}
\]

Among them, \(T\) is the torque through the reducer, \(P\) is the power of the motor, \(\eta\) is the transmission efficiency of the reducer, \(n\) is the rated speed of the motor, \(u\) is the deceleration ratio of the reducer\[4-5\].

3.2. **Design of feeding mechanism**

In this design, the feeding principle of the stirring mechanism is adopted to realize the feeding function of the robot. The mechanism design drawings are as follows:
1. Hopper 2. Esophageal tract 3. Stirring cage 4. Coupling 5. Reduction motor

As shown in Fig. 3, the feeding mechanism is driven by DC motor. The output torque of the motor reaches the output shaft through the reducer, and the output shaft is connected with the stirring cage through the coupling to transfer the torque to the stirring cage. The bait stored in the hopper leaks into the esophagus and is sent out by twisting the stirring cage, thus realizing the feeding function of the robot. Because of the twisting feeding principle of stirring cage used in feeding, feeding can be controlled by controlling the rotation stop of the motor and the speed of the motor, thus realizing the control of feeding[6].

The technical parameters of feeding stirring cage are as follows:

Conveying materials: Granular Fish Feed with Diameter of 1-3 mm
Maximum feeding speed: 20 g/min
Working temperature: 0-40 ℃
Cage large diameter: 12 mm
Cage small diameter: 4 mm
Cage pitch: 15 mm
Cage speed: 50 r/min
Motor power: 0.75 W

4. Circuit and Software Design

4.1. Arduino control circuit design
The main controller uses the Arduino control board, through which the development method of the program can be realized quickly. The L298N is used to drive the motor and the bluetooth module is used to transmit data remotely[7]. The schematic diagram of the control circuit is shown in Fig. 4.
According to this circuit, the Arduino program can be developed to control the motor. The steering trajectory of the small robot can be controlled by writing the algorithm of data processing in the program.

4.2. Software design of mobile phone

The mobile software interface is shown in Fig. 5. The Android system control software of this system is developed by App inventor. With the help of App Inventor, Android development environment can be established more quickly. With any modification to the Android program on the PC side, we can quickly update the content of the program, and we can intuitively see whether the result of the modification achieves the desired effect.

Under these conditions, the control functions of forward, backward, steering, feeding, speed adjustment and gravity induction are developed. When you click on the "Open Gravity" button and turn on the gravity induction function, you can achieve the direction of the robot by tilting the mobile phone; when you click on the "Close Gravity" button, gravity induction fails.

![Mobile App interface diagram]

The overall design process is through the mobile app sender instructions, bluetooth module receives instructions through Arduino analysis judgment instructions, and then according to the relevant instructions to make the corresponding response. Final production is as shown in Fig. 6:

![Production]

5. Conclusion

In this paper, aiming at the application of fishing robot in entertainment, mobile app is used to realize wireless control, which solves the problem that it is difficult to find other remote controllers to match because of the damage of the original remote controller in the market. At the same time, 130 motor is
economical and powerful. And through the experimental verification, the effect is ideal, can flexibly realize the direction of the robot real-time control, and remote feeding function. It realizes the interaction of toy, player and nature, and provides a new idea for the development of remote control toys.

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