The Study of Using Arduino to Control Aircraft Combined with Obstacle Avoidance Warning Function

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Abstract--With the rapid development of UAV technology, more and more sophisticated and simple unmanned aerial vehicles have been brought to market. For the general public however the issue of greatest concern has always been security. At present, it is a key issue for UAV development to realize air safety flight, and the obstacle avoidance function plays a key role in this issue. This thesis adopted the Arduino UNO, rotary ultrasonic, three color light and buzzer as performance of obstacle avoidance warning system, and send warning signals to the mobile phone APP through the WIFI to remind staff operating in advance to avoid an obstruction on the flight path, greatly reduce various kind of harm for error, etc.

Keywords – Security, Obstacle Warning, Arduino-UNO, WIFI.

I. INTRODUCTION

In recent years, unmanned aerial vehicles have been used more and more in various fields, and in these applications, the UAV must be able to perceive and avoid the static and dynamic continuous navigation obstacles [1]. In order to detect obstacles on the voyage, ultrasonic sensors are used as external sensors, and the detected obstacles are used to control the UAV to get around obstacles [2]. In this paper, a kind of obstacle avoidance system with early warning function is put forward in the course of UAV flight. The warning system is composed of rotary ultrasonic, tri-colored light and buzzer, and is controlled by the mobile phone. It is proved by many experiments that this system is feasible and effective for the safe flight of UAV.

II. STRUCTURE

The components of UAV in this study include Arduino UNO, brushless electronic governor, brushless motor and battery, etc. In order to sense the distance data from UAV, we use the traditional ranging sensor --- Air Ultrasonic Ceramic Transducers, and use tricolored lights and buzzers as early warning information to inform the operator the distance between the unmanned aerial vehicle (UAV) and the obstacle. In terms of UAV control, we use the WIFI module to communicate with the UAV, and use the mobile APP to control the UAV. The system structure is shown in Fig. 1.

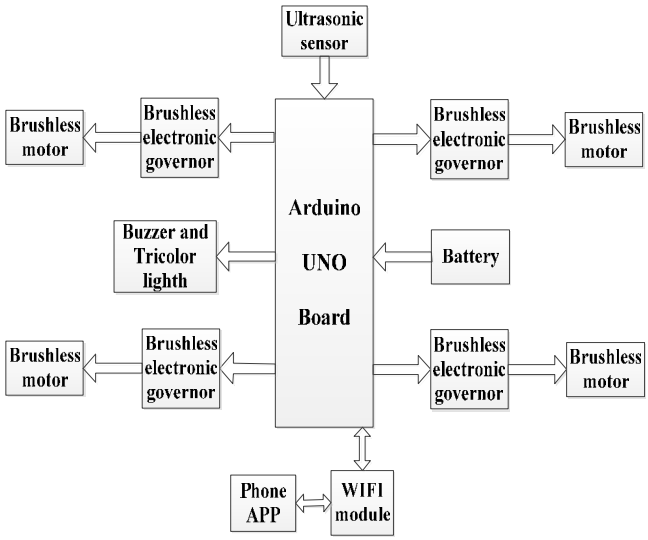

Fig. 1 The control system structure of the aircraft

III. METHOD

A. Ultrasonic and Early Warning System

Ultrasonic ranging is a non-contact measurement method. It is not affected by light and color, and has certain ability to adapt to dark and anti-dust, smoke and electromagnetic interference [3]. UAV in this paper adopted the 180° rotary ultrasonic before and after for distance measurement, which can achieve a full range of measurement and feedback to UAV whether peripheral environment is safe. Ultrasonic detection warning system flow chart is shown in Fig. 2: Ultrasonic detect obstacles ahead constantly at work and determine whether d is within the scope of the warning, if within the scope of the warning, The system will send out the corresponding warning information at different distances, otherwise they will not send out any warning information.

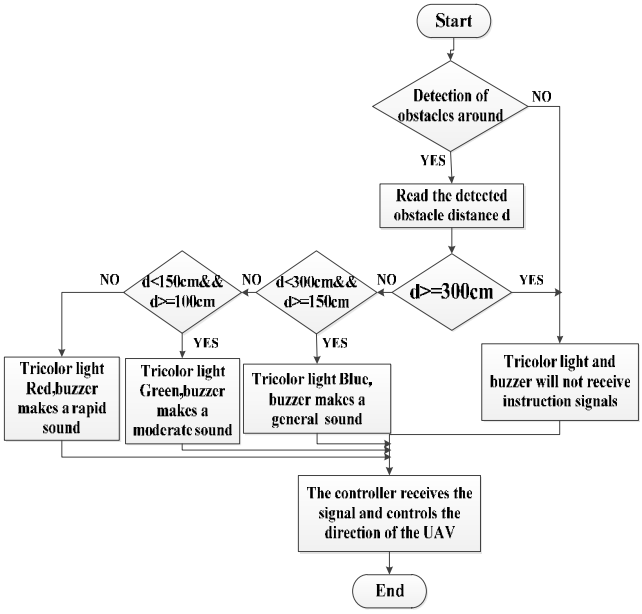

Fig. 2 Ultrasonic warning system flow chart

B. Mobile phone connection WIFI

WIFI has become the de facto configuration for most communication devices, from personal smart phones to industrial instruments [4]. In this paper, the mobile phone APP control system sends information to the WIFI module through the network, the WIFI module receives the information and sends it to the Arduino. The UAV receiving the signal command will start to execute the corresponding command action. The processed data is then returned to the handset via the WIFI module, and the flow chart is shown in Fig. 3.

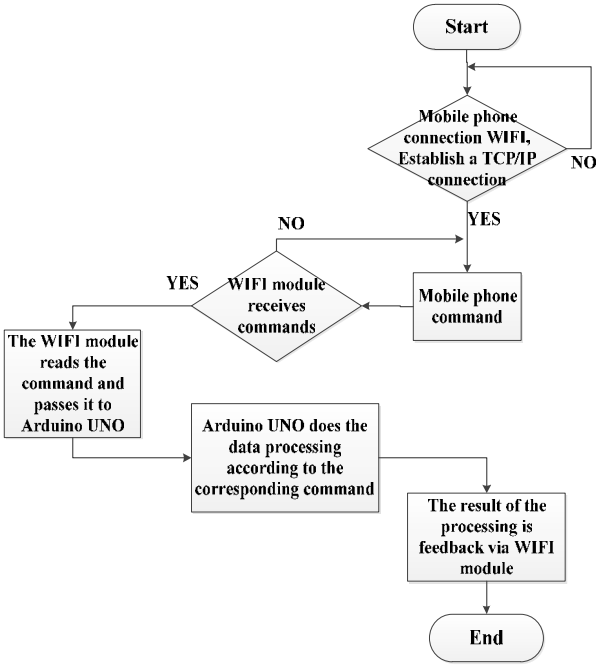

Fig. 3 Mobile phone connection WIFI flow chart

IV. EXPERIMENTAL RESULTS

The experiment is carried out outdoors, the mobile phone connects with the WIFI to send out the control signal, and the UAV performs the corresponding flight action. When there is no obstacle around the UAV, it is flying normally, as shown in Fig. 4(a). When the UAV is to be landed on the ground, taking the landing point as the center of the circle, in the range of one meter radius, we use ultrasonic to detect whether the three positions above the ground are of the same height. If they are consistent, it indicates that there is no obstacle on the ground so it can land safely; otherwise, the safe landing point will be re-detected, as shown in Fig. 4(b).

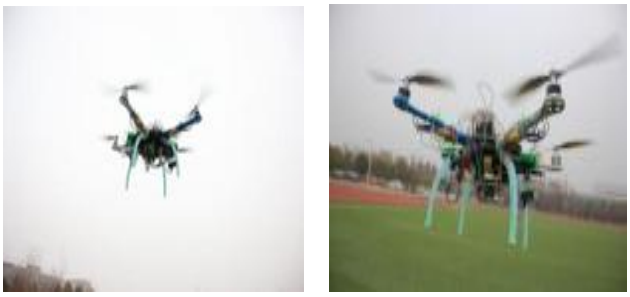

Fig. 4 (a) UAV flight diagram (b) Safety landing chart

V. CONCLUSION

This paper proposes a quadrotor UAV combined with mobile WIFI communication and obstacle avoidance early warning system. It detects and feedback information to the mobile phone terminal by detecting the surrounding environment of about three meters. The experimental results show that the early warning system based on WIFI communication and Arduino control is reasonable and has high security.

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