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Voice Controlled Quadcopter

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Abstract: This paper proposes to create a UAV (quad-copter) that is capable & recognizing of obeying users commands through voice that user uses to simulate and control the quad-copter. The rigid body of quad-copter frame is made up of quality glass fibre and polyamide nylon. It makes possible to fly Quad-copter through difficult terrains and altitudes. The control design and the frame size determine the flight control and stability. The width of quad-copter is 450mm and height is 55mm. The quad-copter weighs around 850 gram (without electronic components it weighs around 270 gram). Each motor generates a thrust of 600 grams (total thrust generated by quad-copter is 2400 grams). Quad-copters generally use two sets of identical propellers, i.e. two CW (clockwise) and two ACW (anticlockwise). By varying the speed of each rotor it is possible to specifically generate a desired total thrust in particular direction. The software required to configure are as follows (Arduino IDE, XCTU, and H-term).

Index Terms: Quad-copter, Voice control, Arduino, Flight control, Wireless ZigBee Module,

1. INTRODUCTION

The Quad-copter is becoming prominent UAV (Unmanned Aerial Vehicle) which is lifted and boosted by four identical rotors. A quad-copter uses two identical pairs of motors and propellers to create thrust and give the total lift in which two motors rotate in ACW (anti-clockwise) direction and the other two motors rotate in CW (clockwise) direction. This arrangement results in total torque equal to null i.e. the corresponding motors are rotating in opposite direction. The pitch, yaw and roll of the quad-copter is controlled by changing the thrust between all four motors unlike helicopters which uses a single large combined pitch rotor to control a conventional helicopter. But quad-copters are commonly controlled by Radio Controller method.

All the common directional movements of a quad-copter are attainable like hover, forward/backward movement, left/right movement, and yaw (turn rate) movement by spinning the four propellers of quad-copter at different speeds. The vehicle is navigated according to the voice commands from the user which selects appropriate throttle, pitch, yaw and roll values accordingly. In such cases if there is a loss in transmission the quad-copter might take some time to respond to the signal. Apart from this voice control method, it can be controlled by conventional RC method by interfacing RF module. The balancing and levelling condition during sight is controlled by flight controller (KK2.1.5) with help of on-board sensors namely accelerometers and gyroscopes, and its output of the sensors is used in smooth levelling.

2. BLOCK DIAGRAM

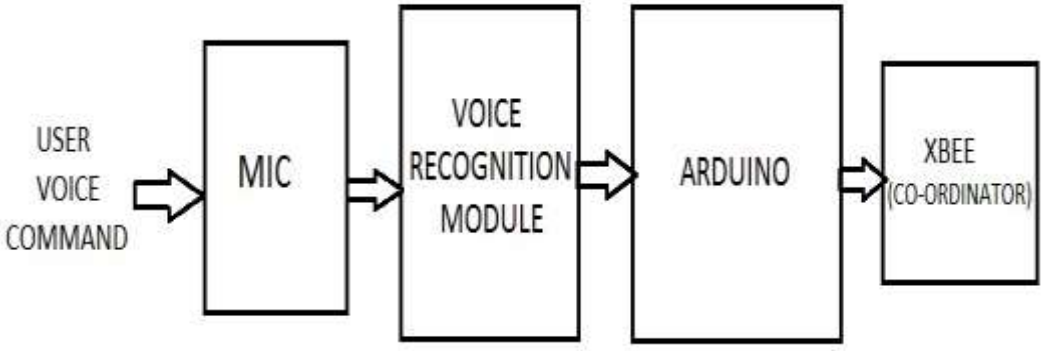

Fig.1: Block Diagram of Transmitter Section

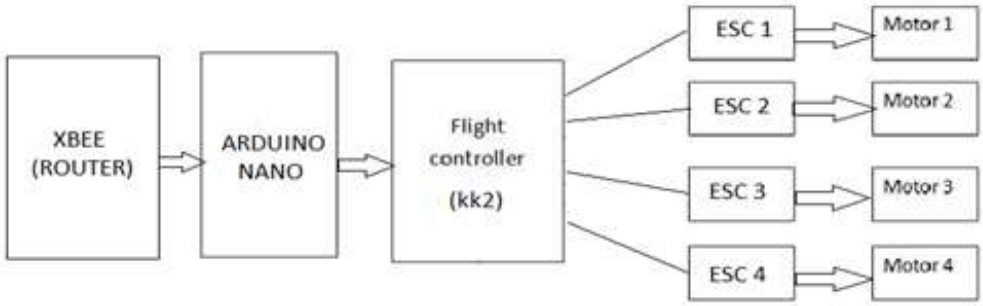

Fig.2: Block Diagram of Receiver Section.

3. HARDWARE USED

ARDUINO UNO

Arduino Uno is used for building devices which can sense & control electronic devices in physical world. In total Arduino Uno ha 14 digital I/O pins.it has 6 PWM pins,6 Analog input pins & amp; rest are digital pinion board crystal oscillator present in Arduino Uno is of 16 MHz.ait can easily connected to a computer with help of USB cable or powered by AC/DC adapter to getting started. Other specification of Arduino Uno, are as follows:

Fig.3: Arduino Microcontroller Board.

- Input Voltage (limits): 6-20 Volts
- DC Current per I/O Pin: 40 mille Amp
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Frequency: 16 MHz

LI-PO BATTERY

The Lithium polymer battery is responsible for powering up the 14000Kv BLDC motors with 5A current and 11.1 V supply.

DC Motors (BLDC)

BLDC motors i.e. Brushless direct current electric motor is also known as ECMs, EC motors (electronically commutated motors) are synchronous motors that are powered by a DC power supply via an integrated inverter/switching power supply, which produces an alternating current electric signal to driven the motor.

ELECTRONIC SPEED CONTROL UNITS (ESC)

It is an intermediator circuit responsible for driving high RPM BLDC motors. To empower a three phase brushless dc motor, it takes PWM input from the microcontroller and reproduces the same at the other end with distorted phases in 120 degrees. Meanwhile it changes the frequency from 500Hz to 3000-5000Hz.It also has an inbuilt battery eliminator circuit to supply onboard components.

Fig.4: Electronic speed control unit.

4. SOFTWARE DESCRIPTION

XCTU

The XCTU utility has the ability to record the frames sent from the XCTU utility to the devices.

- Launch XCTU
- Click on "Add Radio Module" and select the appropriate UART
- In the top right, click on the Computer Display icon "Switch to Consoles working mode"
- Click on the "Open" icon.
- Click on the "Record" icon and select where you want the log file to go.
- Click on "Detach" if you'd like the frame log window to be detached from the main window.
- Go and do things in the XCTU program and the various frames sent & received will be recorded in the log file.
- When you're done, switch back to the Consoles working mode and click on "Stop"

AURDUINO IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

XBEE 2.4GHz Zigbee module

XBEE is a wireless modem by DIGI, under ZIGBEE 802.15.4 protocol to communicate between two wireless radios. It works on 2.4 GHz carrier frequency. It adopts Frequency Hopping Spread Spectrum technique (FHSS).

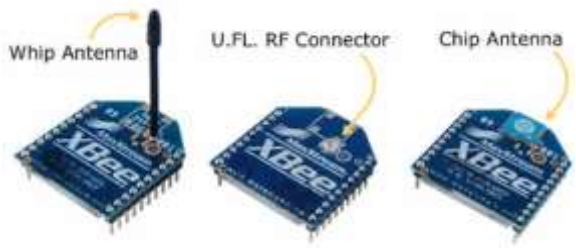

Figure 3. XBee Modules

Fig 5: Zigbee module.

USB Adapter for ZigBee

These are USB to FTDI convertor boards with Headers for ZigBee's basement. It also has pins fabricated for Breadboard mounting purposes.

KK2.1.5 Board (Flight Control Board)

The KK2.1 Multi-Rotor controller is a flight controlboard for multi-rotor aircraft (Tricopters, Quadcopters, Hexcopters etc). Its purpose is to stabilize the aircraft during flight. To do this it takes the signal from the 6050MPU gyro/acc (roll, pitch and yaw) then passes the signal to the Atmega644PA IC.

5. DETAIL DESCRIPTION OF SYSTEM

Transmitter Section

Transmitter section consists of 4 blocks are as follows:
1. Mic.
2. Voice recognition module.
3. Arduino.
4. Xbee(Co-ordinator).

The user voice command is converted into electrical signal with the help of Mic. This electrical signal is further provided to voice recognition module. The voice recognition module can record up to 15 voice instructions. This electrical voice signal is recognized by voice module, the recognized voice commands are compared with pre-recorded voice commands. Accordingly it will generate the hex value. Arduino Uno compares the Hex value with the program code and prints the string serially with the respect to the cases for e.g.: (back, forward, left, right). This string value is transmitted to Xbee where the Xbee works as co-ordinator.

Receiver Section

Recevier section consist of following blocks
1 Xbee(Rouster).
2 Arduino Nano.
3 Flight Controller.
4 ESC.
5 Motor.

In revecier section Xbee act as a router which receives data i.e string from coordinator, this string data is available at serial terminal of Arduino nano. Flight controller kk2 board action pins are connected to Arduino PWM pins.Arduino nano compares this serial data with written code & generates PPM(pulse positon modulation) from

PWM pin. According to the PPM input from Arduino, kk2 board can be controlled. Flight controller have on-board sensors like accelerometers, gyroscope which helps to maintain stability of quadcopter. The rotation of the motor is controlled by ESC which receives input from kk2 board.

6. CONCLUSION

We have implemented a quad-copter that can be distantly controlled by User voice commands, with the help of which we can customize a new way to match the convenient of the user. For making the drone we are using a light controller module with Arduino board. With the help of Arduino board we can stabilize the quad-copter and we can navigate the quad-copter in particular directions with the help of voice commands. This system can be user independent or user dependent.

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