The narrow space aircraft design

CUMT

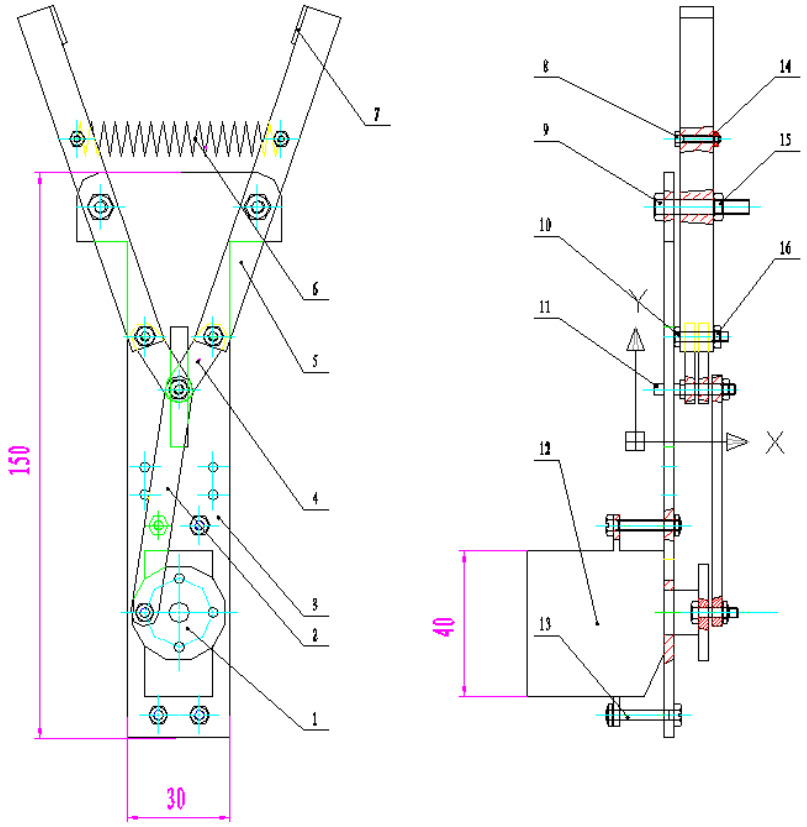
Abstract:In recent years, the broad application of the military and civil market needs andunique advantages to promote the development of a four-rotor aircraft (QuadrotorHelicopter). Independently design and production of prototype four-rotor aircraftdynamics and power system dynamic model and Kalman filter is used attitude solution and part of the attitude control using a PID (Proportional IntegralDerivative) controller. The four-rotor aircraft flight control system to determine the pros and cons of the four-rotor aircraft flight performance.

First of all, the four-rotor aircraft flight principle is introduced, established adynamic mathematical model; On this basis, the complete flight control systemhardware and software design, component selection, hardware circuit design,system software design. Second, establish a perfect four-rotor aircraft flight control system platform will help further expand the four-rotor aircraft flightnavigation and control algorithms and control systems development for the futureto further study the new multi-purpose development to meet the differentconditions UAV lay a solid foundation. Finally, the four-rotor aircraft flight testsverified the feasibility of Kalman filtering and PID controller algorithm.

Key words: four-rotor aircraft modeling Kalman filter PID Information science Right hand algorithm Mean Shift

Manipulator design

In order to understand the importance of Manipulator of compliant ,focus on the position control and fingers analysis. Hypothesis robot arm is a rigid,if object is solid, two in the position of the relationship and produced error, so in order to absorb the position error, to make the position control with fingers and has the function of flexibility. That is, before the object is to contact with object previous, we must control is its with larger complaisant , so as to adapt to the object. 2 in the positioning after the action of the object to do, in order to bear the force control with fingers closed reaction of action, must want to its compliant sex smaller. From that position control with fingers in the positioning is in action is stepping up and set by the compliant and the opposite, the above with two independent function finger control for general hand touching the order of stepping up are the characteristics of the function. This can be said for general hand the required characteristics, two for special hand, it should use to see as much as possible ways, such as the material or institutions designed to meet the requirement.



Realization strategies:The whole control system is divided into three parts, and set high cruise system, loading in the air of the robot tra layer, in the air after the launch of the robot, keep constant cruising altitude, avoid the upper control algorithm influence the air crash of the robot. The room search system, loading in the air of the robot decision-making, using the right hand one room search algorithm, and then start to room U plate recognition system. U plate recognition system, load in the air of the robot should measure layer, using image recognition algorithms, identify U plate and calibration position.

Plastic gear design

Gear parameter design calculation

computational item	computational process	reckoning
Pitch diameter d	$d = mz = 44 \times 1.5 = 66\,mm$	d=66mm
center distance a	$a = \frac{d_1 + d_2}{2} = 66\,mm$	a=66mm
tooth thickness s	$s = 1.91\,mm$	$s = 1.91\,mm$

Rack of displacement y	$y=\frac{s-s_{BR}}{2\tan\alpha}=\frac{1.91-2.3562}{2\tan 20}=-0.613$	$y=-0.613$
tip diameter d_{ae}	$d_{ae}=d+2(y+h_{aBR})=66+2*(-0.613+1.5)=67.774$ ㎜	$d_{ae}=67.774$ ㎜
Base diameter d_b	$d_b=d\cos\alpha=66*\cos 20=62.020$ ㎜	$d_b=62.020$ ㎜
root diameter d_f	$d_F=\sqrt{d_b^2+\frac{(2y+d\sin^2\alpha_t-2h_{fFBR})^2}{\sin^2\alpha_t}}=62.790$ ㎜	$d_F=62.790$ ㎜
No root cut judgment type B_T	$B_T=(2y+d\sin^2\alpha_t-2h_{fFBR})=3.354\geq 0$	$B_T=3.354$
Top gear the starting point margin diameter d_T	$d_T=\sqrt{d^2+4d(h_{aTBR}+y)+[\frac{z(h_{aTBR}+y)}{\sin\alpha}]^2}=66.932$ ㎜	$d_T=66.932$ ㎜
Calculation with parameters h_{aeBR}	$\alpha_{ae}=\arccos(\frac{d_b}{d_{ae}})=23.78$ 、 $h_{aeBR}=0.5d_b\sin\alpha(\tan\alpha_{ae}-\tan\alpha)-y=1.4261$ ㎜	$h_{aeBR}=1.4261$ ㎜
Top gear the margin radius R_{TBR}	$R_{TBR}=4m=6$	$R_{TBR}=4m=$
Top gear down circle radius r_T	$r_T=0.1$㎜	$r_T=0.1$㎜
Tooth repair of the top margin v_{Tae}	$v_{Tae}\approx\frac{(h_{aeBR}-h_{aTBR})^2}{2R_{TBR}\cos^2\alpha}=0.0313$	$v_{Tae}=0.0313$

No fix teeth s_{Tae}	$inv\alpha = \tan\alpha - \alpha = \tan 20 - \frac{20}{180}\pi = 0.0149$ $inv\alpha_{ae} = \tan\alpha_{ae} - \alpha_{ae} = \tan 23.78 - \frac{23.78}{180}\pi = 0.0256$ $s_{Tae} = d_{ae}(\frac{s}{d} + inv\alpha - inv\alpha_{ae}) = 0.721$mm	$s_{Tae} = 0.721$ m m
bottom clearance C_{BR}	$C_{BR} = a - \frac{d_{ae} + d_f}{2} = 0.721$ mm	$C_{BR} = 0.721$ m m
Root round radius ρ_f	$\rho_f = 0.5372$	$\rho_f = 0.5372$

①Skip across K $k = \frac{\alpha}{180}z + 0.5 - \frac{2x\tan\alpha}{\pi}$ $k = 4$;

②length W $W = m\cos\alpha[\pi(k - 0.5) + zinv\alpha + 2x\tan\alpha] = 12.57$

Four rotor vehicle dynamic equation

In order to establish the system dynamics model, defined as shown in figure 2-3 below shows the two coordinate system, respectively for the ground coordinate system E (X, Y, Z) and object coordinate system B (X, Y, Z). Make R ∈ SO (3) as the coordinate transformation matrix, it gives the relative to the ground object coordinate system B coordinate system the orientation of the E. The next is deduced and the expression of the coordinate transformation matrix R, round the x, y, z axis rotation x, y, z the euler Angle Θ = [φ θ ψ] T ∈ S3 parameterization to fulfill. R ∈ SO (3) is in accordance with the x, y, z axis of the sequence of the rotation transformation.

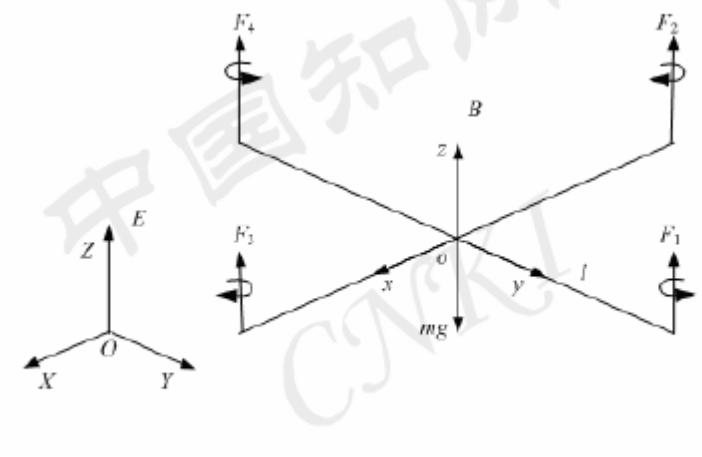


图 2-3　物体坐标系 B 和地面坐标系 E 间的关系
Fig.2-3 Map of body fixed frame B and earth fixed frame E

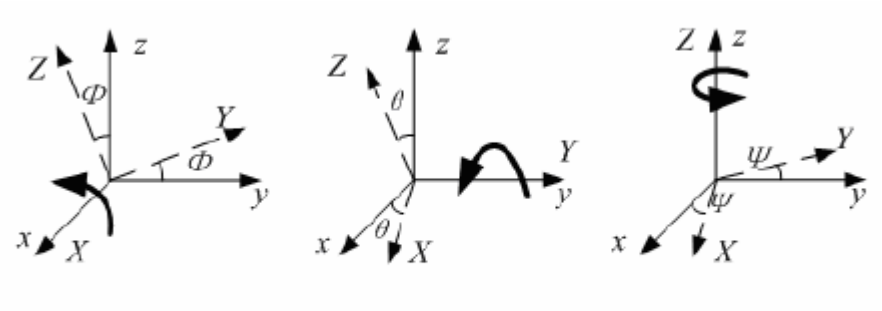


图 2-4　滚动、俯仰和偏航示意图
Fig.2-4 Rotations in roll, pitch and yaw

Figure 2-4 available to the ground object coordinate each axis of the transition matrix coordinate system, respectively, said for type (2-1), type (2-2) type (2-3) :

$$R(x,\varphi)=\begin{bmatrix}1 & 0 & 0\\ 0 & \cos\varphi & -\sin\varphi\\ 0 & \sin\varphi & \cos\varphi\end{bmatrix} \qquad (2\text{-}1)$$

$$R(y,\theta)=\begin{bmatrix}\cos\theta & 0 & \sin\theta\\ 0 & 1 & 0\\ -\sin\theta & 0 & \cos\theta\end{bmatrix} \qquad (2\text{-}2)$$

$$R(z,\psi)=\begin{bmatrix}\cos\psi & -\sin\psi & 0\\ \sin\psi & \cos\psi & 0\\ 0 & 0 & \end{bmatrix} \qquad (2\text{-}3)$$

φ ——Along the x axis direction of the rolling Angle (rad；

θ ——Along the y direction elevation Angle (rad)；

ψ ——The z axis direction along the yaw Angle (rad)

Because R ∈ SO (3) is in accordance with the x, y, z axis of the sequence of the rotation transformation, SO to get the object coordinate system to the ground of the E B coordinate transformation matrix: the coordinate transformation matrix calculated the ultimate form of type (2-5), this type as the next quarter four rotor dynamic characteristics of the helicopter is an important basis for model.

$$R(\theta,\varphi,\psi)=\begin{bmatrix}\cos\psi\cos\varphi & \cos\psi\sin\theta\sin\varphi-\sin\psi\sin\varphi & \cos\psi\sin\theta\cos\varphi+\sin\psi\sin\varphi\\ \sin\psi\cos\theta & \sin\psi\sin\theta\sin\varphi+\cos\psi\cos\varphi & \sin\psi\sin\theta\cos\varphi-\sin\varphi\cos\psi\\ -\sin\theta & \cos\theta\sin\varphi & \cos\theta\cos\varphi\end{bmatrix}$$

Dynamics analysis

Role to four suspended wing vertical take-off and landing force and torque is on board with all four propeller force and torque produced the synthesis of the effect. Need to point out is, four from the propeller force and moment of great cross coupling between. For example, rolling (pitch) torque changes will be to lateral (vertical) acceleration has a direct influence. To cross coupling and and the four suspended wing vertical take-off and landing machine the inertia of the related further analysis has been presented. For a single propeller force and torque modeling brought about by the complexity is beyond the scope of this essay, so below will put helicopter modeling for set total system, and assume that all four of the propeller shaft can be very good and (vertical) the z axis parallel alignment. Define thrust T ∈ R for four propellers lift combined. Therefore, in the object coordinate system of physical FB said that = [0 0 T] T do not contain the x and y directions component. So object coordinates force of the vehicle for:

$$F_B=\begin{bmatrix}F_x\\F_y\\F_z\end{bmatrix}=\begin{bmatrix}0\\0\\\sum_{i=1}^{4}F_i\end{bmatrix} \quad (2\text{-}6)$$

According to the given in section 2.2.1 ground coordinate system to coordinate system of B E object coordinate transformation matrix, it can be seen that the ground force of the object coordinate system for:

$$\begin{bmatrix}F_x\\F_y\\F_z\end{bmatrix}=\left(R_{EB}\cdot F_i\right)\begin{bmatrix}\sin\psi\sin\phi+\cos\psi\sin\theta\cos\phi\\-co\psi s\sin\phi+\sin\psi\sin\theta\cos\phi\\\cos\phi\cos\theta\end{bmatrix} \quad (2\text{-}7)$$

According to Newton's second law of further, it is known that the ground coordinate system x, y, z three of the direction of displacement equations of motion lines are as follows:

$$\begin{cases}\ddot{x}=(F_x-K_1\cdot\dot{x})/m\\ \ddot{y}=(F_y-K_2\cdot\dot{y})/m\\ \ddot{z}=(F_2-mg-K_3\cdot\dot{z})/m\end{cases}$$

The air resistance coefficient is Ki. These coefficient in low speed can be ignored. Therefore, under the motion equation can be used under force and moment balance definition. Similarly, according to euler equation can get four suspended wing vertical take-off and landing machine Angle motion equation for:

$$\begin{cases} \ddot{\varphi} = l(F_4 - F_2 - K_4\dot{\varphi}) / I_x \\ \ddot{\theta} = l(F_3 - F_1 - K_5\dot{\theta}) / I_y \\ \ddot{\psi} = (M_1 - M_2 + M_3 - M_4 - K_6\dot{\psi} \cdot l) / I_z \\ = l(F_1 - F_2 + F_3 - F_4 - K_6\dot{\psi}) / I_z \end{cases} \quad (2\text{-}9)$$

By type (2-8) type (2-9) can further get four suspended wing vertical take-off and landing machine at the end of the day the kinematics model equation for:

$$\begin{cases} \ddot{x} = (F_x - K_1 \cdot \dot{x}) / m \\ \ddot{y} = (F_y - K_2 \cdot \dot{y}) / m \\ \ddot{z} = (F_2 - mg - K_3 \cdot \dot{z}) / m \\ \ddot{\varphi} = l(F_4 - F_2 - K_4\dot{\varphi}) / I_x \\ \ddot{\theta} = l(F_3 - F_1 - K_5\dot{\theta}) / I_y \\ \ddot{\psi} = (M_1 - M_2 + M_3 - M_4 - K_6\dot{\psi} \cdot l) / I_z \\ = l(F_1 - F_2 + F_3 - F_4 - K_6\dot{\psi}) / I_z \end{cases} \quad (2\text{-}10)$$

1 is the focus of the helicopter to each of the long arm of the propeller, Mi is the first I a propeller of the moment, I is corresponding to the axis of inertia, I 'z including the z axis of inertia moment and force the zoom factor to the moment. The definition of the controlled object of input volume, that amount control for: comprehensive type (2-10) and (2-11), can get system equation of motion into:

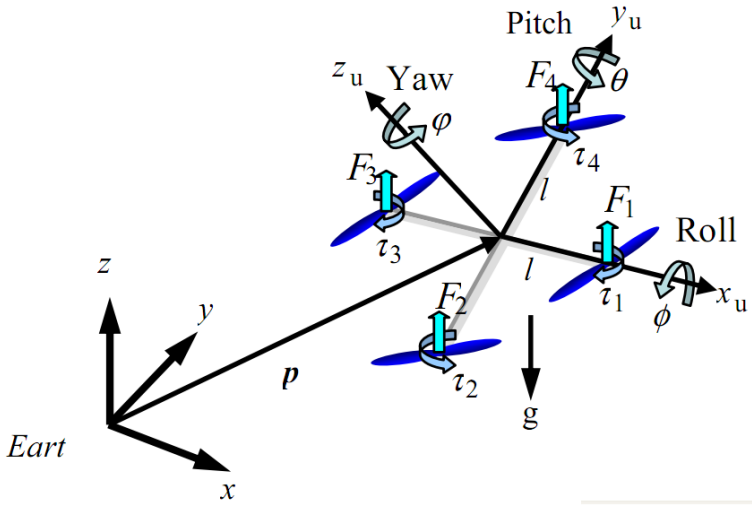
$$\begin{cases} x = (u(1)(\sin\sin + \cos\sin\cos) - K1x) / m \\ y = (u(1)(\sin\sin\cos - \cos\sin) - K2y) / m \\ z = (u(1)\cos\cos - K3z) / m - g \\ = (u(2) - K4)l / Ix \\ = (u(2) - K4)l / Ix \\ = (u(2) - K4)l / Ix \end{cases}$$

Four rotor aircraft mathematical model and simplified

Four rotor aircraft to the control of the premise is to establish the mathematical model of vehicle system. Set a model is four rotor vehicle research, the design, the simulation experiment and application of the foundation. Therefore, the study a matter before, was established to study and appropriate model of credible has very important significance. This chapter four rotor of the flight vehicle to air dynamic characteristics are analyzed, and establish its model. Based on the mathematical model, using linear and nonlinear control technology, the design applies to system controller. Four rotor with fixed wing aircraft flying compared with the aerodynamic is nonlinear and unsteady, and pneumatic environment is much more complex, so it is difficult to establish the accurate mathematical model. Because of its unique structure four rotor aircraft characteristics, must use the closed-loop control, therefore, control law design must put aircraft object to the dynamic included, not only should consider the rigid body plane static and dynamic characteristics should become angry, consider the main vehicle elastic dynamic mode. Dynamic model and simulation model is from a series of simple equation develops. For a complex

mathematical model may be air dynamics analysis, sensors and coefficient of dynamic system model. Finally, through the various flight experiments to verify whether modeling accurate and valid. Due to the model is nonlinear, so need linearization. According to the dynamic model of the four rotor aircraft, the Euler equation methods numerical-Lagrange established.

Four rotor drone coordinate system, when thrust Fi and the torque ti role in fixed in mobile coordinate system, the inertia coordinate system in the movement equation of the equation as follows



$$\begin{bmatrix} m & 0 & 0 \\ 0 & m & 0 \\ 0 & 0 & m \end{bmatrix}\begin{pmatrix} \ddot{x} \\ \ddot{y} \\ \ddot{z} \end{pmatrix}+\begin{pmatrix} 0 \\ 0 \\ mg \end{pmatrix}+K_f\begin{pmatrix} \dot{x} \\ \dot{y} \\ z \end{pmatrix}=R(\phi,\theta,\varphi)F$$

$$\begin{bmatrix} I_x & 0 & 0 \\ 0 & I_y & 0 \\ 0 & 0 & I_z \end{bmatrix}\begin{pmatrix} \ddot{\phi} \\ \ddot{\theta} \\ \ddot{\varphi} \end{pmatrix}+K_m\begin{pmatrix} \dot{\phi} \\ \dot{\theta} \\ \dot{\varphi} \end{pmatrix}=M$$

$$R(\phi,\theta,\varphi)=\begin{pmatrix} c\varphi c\theta & c\varphi s\theta s\phi-s\varphi c\phi & c\varphi s\theta c\phi+s\varphi c\phi \\ s\varphi c\theta & s\varphi s\theta s\phi+c\varphi c\phi & s\varphi s\theta c\phi-c\varphi s\phi \\ -s\theta & c\theta s\phi & c\theta c\phi \end{pmatrix}$$

The overall design and four rotor aircraft hardware system

processor

STM32

STM32 series based on designed for high performance requirements, low cost, low power consumption embedded application special design of ARM Cortex-M3 kernel. According to the performance is divided into two different series: STM32F103 "enhanced" series and STM32F101 "basic" series. Enhanced series to 72 MHz clock frequency, is similar products in the performance of the highest products; Basic clock frequency of 36 MHz, with 16 prices of the products get more than 16 products improve performance, is 16 product the best choice of the user. Two series are built-in 32 K to 128 K flash memory, the difference is the SRAM maximum capacity and peripherals interface combination. The clock frequency

72 MHz, from flash code implementation, STM32 power consumption and mA, 32 bits of the lowest power consumption of products on the market, the equivalent of 0.5 mA/MHz. This topic of choice for STM32F103RX. STM32F103RX 3.1.1&3.1.2

Characteristics:

The kernel:-ARM 32-bit Cortex-M3 CPU-the highest 72 MHZ working frequency, in memory of 0 of waiting period when access up to 1.25 DMisp, MHZ (DhrystONe2.1)-single cycle multiplication and hardware division, and memory:--from 64 K or 128 K bytes of flash memory program memory as high as 20 K bytes-the SRAM

Navigation module

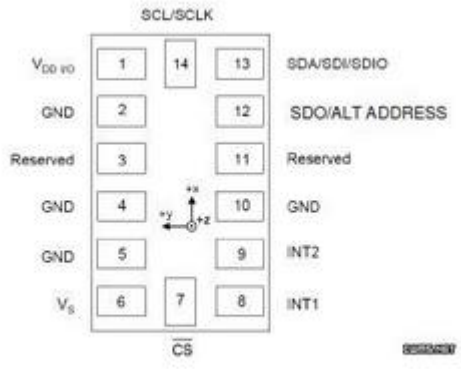
Acceleration sensor

Acceleration sensor is a able to measure the acceleration of electronic equipment. Acceleration is when objects in the process of accelerating in the role of the forces on the object, like gravity, also is gravity. Acceleration can is a constant, such as g, also can be the variables. Accelerometer has two kinds: one kind is Angle accelerometer, is by the gyroscope (angular velocity sensor) improvement. Another is linear accelerometers.

The principle of linear accelerometers is inertial principle, also is the balance of force, A (acceleration) = F (the inertial force) / M (quality) we only need to measure F. How to measure F? Electric magnetic force to balance the force. Can get corresponding to the relationship between the current F. Only use the experiment and the proportion of calibration coefficient will do. Of course in the middle of the signal transmission, amplification, filter is circuits.

This topic selection of ADI company ADXL345. ADXL345 is ADI company in 2008 with the launch of the MEMS technology has SPI and the I2C digital output function of the three accelerometer, with small light, low power consumption, variable range, high resolution characteristics: it only 3 mm x 5 mm multiply one mm appearance size, surface runoff 1/3 of the size of ZhiJiaGai; In A typical voltage VS = 2.5 V current consumption when about 25 ~ 130 μ A, earlier than the analog output of products ADXL330 typical values low power consumption of about 70-175 μ A; Most large ranges over ± 16 g, the other can select ± 2, ± 4, ± 8 g range, can use fixed 4 mg/LSB resolution model, this resolution can be measured 0.25 ° Angle of change.

ADXL345 provide some special motion detection function, can detect whether an object in motion state, and can be a sensitive axial acceleration whether to exceed the user defined threshold, can detect whether the object is on the decline. In addition, has integrated a 32 magnitude FIFO buffer, used to cache data in order to reduce the burden of the processor. ADXL345 can tilt sensitive in application of static gravity acceleration measurement, also can be in sports or even vibration environment to measure dynamic acceleration, which is very suitable for mobile equipment applications, should be on the mobile phone, games and positioning equipment, small small-sized navigation equipment, hard drive protection, sports fitness equipment, digital camera, etc. Products have been widely used.



gyroscope

Using high-speed back to the swivel the sensitive shell relative solve dynamical problems around the space at the inertia of orthogonal axis of one or two of the shaft Angle motion detection device. Use of the other principle of the Angle motion detection device is made up of the same functionality also says the gyro. Around a fulcrum high-speed rotating rigid body called gyro (top). Usually said gyro is referring to symmetrical gyro, it is a quality of uniform distribution, an axial rigid body shape, its geometry axis of symmetry is its spin axis. After the fly wing (degenerate into balance bar) bionic to come.

In a certain initial conditions and certain external torque effect, will be on the top of the rotation at the same time, still around another fixed rotor spinning, this is the gyroscope spin into (precession), also known as rotary effect (gyroscopic effect). Gyroscope spin into is common in the daily life of the phenomenon, many people have played as a child of the gyro is an example. People use gyro the mechanics properties of various function made the gyro device is called the gyroscope (gyroscope), it in science, technology, military, and other fields in a wide range of applications. For example: rotary compass, directional indicator, shells of inside out, move, the earth, the chapter in the sun, the moon) lead torque under the action of into (minus) spin.

The gyroscope's principle is, a rotating object referred to in the direction of the axis of the external force not influence, is never change. People according to this truth, and use it to keep direction, making it just call the gyro. The gyroscope in the job will give it a force, make it rapidly rotating up, general can achieve every minute of hundreds of thousands of turn, can work long time. Then use a variety of methods to read the direction of the axis instructions, and automatic control system to the data signals in real life, the gyroscope happened to exercise is gravity into in the role of the moment occurred under.

This topic selection L3G4200d, L3G4200d is a low power three axis angularrate sensor can provide an unprecedented level of sensitivity and the stability of the zero with temperature and time. It includes a sensor and an integrated circuit interface can provide the external world angular velocity measurement through a digital interface (IIC/interface).

The sensing elements is using special micro processing technology development of stmicroelectronics production inertial sensors and actuators silicon chips. Integrated circuit interface using production technique, high integration design a dedicated circuit, is to better match the characteristics of the sensor. L3g4200d have comprehensive ±

250500/2000 / ± ± output and can be used to measure the rate and users can choose of bandwidth. L3g4200d can be in a plastic gate array (, can be in a temperature range-40 ℃ to + 85 ° C

Electronic compass

Electronic compass, also called digital compass is the use of magnetic field to set a method of the arctic. Ancient called compass, modern use advanced processing the production of magnetic resistance sensor for the digital compass provides a powerful help. Now generally useful magnetic resistance sensor and the magnetic flux door processing from the electronic compass.

Electronic compass can be divided into the plane electronic compass and three dimensional electronic compass. Plane electronic compass requirements must keep users in the use of the level of the compass, or when a compass happen when tilt, also can give the change and actually heading heading and no change. Although the plane to use electronic compass demanding, but if you can guarantee a compass carrier attached to that level always, plane compass is a cost-effective very good choice. 3 d electronic compass overcome the plane electronic compass in the strictly limited use, for three dimensional electronic compass in its internal joined the tilt sensors, if a compass happen when can tilt to compass tilt table compensation, so that even if a compass happen tilt, heading data still is accurate and correct. Sometimes in order to overcome the temperature drift, compass can also built-in temperature compensation, minimize dip Angle and pointing Angle of temperature drift.

3 d electronic compass by 3 d magnetic resistance sensor, dual axle tilt sensors and MCU composition. 3 d magnetic resistance sensor used to measure the earth's magnetic field, dip Angle sensor is in the state level magnetometer to compensate; MCU processing magnetometer sensor and the inclination of the signal, and the data output and soft iron, hard iron compensation. The magnetometer by three is mutually perpendicular magnetic resistance sensor, each shaft sensor detection in the upward direction of magnetic field strength. The direction of the forward the direction of the sensor test called x to the direction of the magnetic field in the x vector value; The left or the sensor test to Y directions in the direction of the magnetic field Y vector value; Down or Z direction of the magnetic field sensor detection in Z direction of the vector value. Each of the direction of the sensitivity of the sensor are already in this direction according to the points vector magnetic field shangdi adjusted to the best point, and has very low sensitivity of the horizontal axis. The analog output signal sensors produce enlarged to deal with after MCU. Magnetic field measurement range is +-2 Gauss. By the use of the 12 of the A/D converter, magnetometer can identify the less than 1 mGauss magnetic field changes quantity, then we can through the high range resolution to accurately measure the 200-300 mGauss X and Y directions of the magnetic field intensity, both in the equator upward in the polar changes or the more low value position.

This topic chosen for HMC5883L, honeywell HMC5883L is a kind of surface mount high integration module, and with digital interface of the weak magnetic sensor chip, to be used in low cost a compass and magnetic field testing field. HMC5883L including the most advanced high resolution HMC118X series of magnetic resistance sensor, and the integrated circuit with honeywell patent including amplifier, automatic degaussing drive,

and deviation calibration, can make a compass accuracy control in 1 ° ~ 2 ° 12 a adc. Simple and easy the I2C bus interface series. The HMC5883L is lead-free surface packaging technology, with 16 pins, size of 3.0 X3.0 X0.9 mm. The HMC5883L applications have mobile phones, laptops, consumer electronics, car navigation system and personal navigation system.

Height measurement

Pressure sensor

Some air pressure sensor main sensor is a pressure sensitive to the film, it connects a flexible resistors. When measured by the gas pressure to reduce or increase, this film deformation, this resistor of the resistance will change. Resistors of the resistance change. From the sensor get 0-5 V signal voltage, after A/D conversion by data collector accept, then data collector with proper form sent to the computer. Some air pressure sensor for the main parts change let type silicon membrane box. When the variable let silicon membrane box outside air pressure change, monocrystalline silicon membrane box with elastic deformation happened, cause a silicon membrane box of the parallel plate capacitor electric capacity of the change in air pressure altimeter is aerogeophysical measurement, placed in the plane, the use of air pressure with the height of the relationship, through the observation pressure measurement plane flying altitude (also called absolute height) instrument

Ultrasonic sensors

Ultrasonic sensor technology application in different aspects of production practice, and the medical application is one of its main application, for example here in medical ultrasonic sensor technology application. In the application of ultrasonic medicine is mainly to diagnose diseases, it has become the indispensable to the clinical medicine diagnosis method. The advantages of ultrasound in the diagnosis of client holds no pain, no damage, the method is simple, clear, and the accuracy of diagnostic imaging higher. Thus promote easy, by medical workers and patients welcome. Ultrasonic diagnosis can be based on different medical principle, we'll see if there are representative of the one of the so-called type A method. This method is to use the ultrasonic reflection. When ultrasound in human tissues spread meet two layers of acoustic impedance of different media interface is, in the interface is reflected the echo. Each meet a reflective surface, the echo in the oscilloscope display, while the two interface impedance difference also determines the echo of the amplitude of high and low.

motor

Brush dc motor from motor subject and drive component is a kind of typical electromechanical products. Brushless motor is to point to no brush and commutation (or set the ring) of motor, and says no motor commutator. Early in the last century was born of the motor, produce the practicability of brushless motor is forms, namely exchange a rat trap type asynchronous motor, this kind of motor a wide range of applications. But, asynchronous motor has many can't overcome the defect, so that the motor technology development is slow. By the middle of this century was born transistors, thus reversing the transistor circuit with the commutator instead of brush brushless dc motor was born. This new type of brushless motors called electronic reversing dc motor, it overcomes the first generation of brushless motors defects.

Advantages:
A) electronic change have in place of the traditional mechanical commutation, reliable performance, there can be no wear, low failure rate, life is a brush motor increases about six times, representing the development direction of the electric vehicle;
B) of static motors, small idle current;
C) high efficiency;
D) and small volume.
Faults:
A) low speed vibration is slight starting, such as speed increase commutation frequency increases,'t feel vibration phenomenon;
B) the price is high, the controller high requirements;
C) easy to form the resonance, because any one thing there is a inherent frequency, if brushless motors of the vibration frequency and vibration frequency of plastic frame or same or close to it when he got form resonance phenomenon, but can adjust will resonance phenomenon reduced to the minimum. So the brushless motor drive electric motor car sometimes will issue a buzzing sound is a normal phenomenon.
This topic selection new west of 2212 series (A2212) outside the rotor brushless motor
The electricity-motor drive modules
The full name of the electronic governor, English electronic speed controller, hereinafter referred to as the ESC. According to different motor, can be divided into a brush electronic governor and brushless electronic governor. It according to the control signal regulating motor speed. For their connection, usually is this:
1, electricity adjustable input lines and battery connection;
2, the electricity output line (a brush root, and two brushless three root) and motor link;
3, electricity the signal and receiver connection.
In addition, the general electric power output functions, namely in the signal lines between anode, about 5 V voltage output, through the signal power supply for receiver, the receivers again for steering gear control equipment such as power supply. The output of the electricity for three to four steering gear power supply is no problem. Therefore, electric aircraft, generally don't need separate receiver for power supply, unless the steering gear many or in the receiver power has high requirements.
This subject chooses is good win skywalker 40 A electricity to tone.
Communication module
Wireless remote remote control
Is a wireless transmitting device, through the modern digital coding technology, the key information coding, through the infrared ray diodes launch light, light waves of infrared receiver by the receiver will receive the infrared signal turned into electrical signals, and into the processor decoding, demodulation out the corresponding instruction to achieve control of set-top boxes to complete the equipment such as the operational requirements. Through the remote control of aircraft can be manually control. Control of its forward retreat, yaw etc, also can be used as a wireless switch device.
The subject of the rotation for the wireless remote control suites channel, basically meet the control requirements of four rotor.
Wireless digital module

Wireless communication module is four unmanned helicopter rotor as an important part of the station to realize four rotor of unmanned helicopter flight control and track the position, and four rotor unmanned helicopter can take their own state information and video image next to a station, researchers used for analysis.

Wireless digital is what we speak of wireless data transmission, can also be called as the wireless digital terminals, wireless digital module, he can use now we all know GPRS, CDMA such communication network, also can use special wireless digital module to operation, such as ZigBee, microwave, WiFi, etc for the convenience of debugging and shuttle to wireless control, the subject chosen based on a serial wireless digital module, convenient and reliable testing more convenient.

Power supply module

Power as a source of power of the flight vehicle, the status of the system is extremely important, four unmanned helicopter rotor to stable work must have stable power supply as security for the system modules provide motivation. Stable power can make the system in all sorts of environments long stable job, and if power supply module design enough is reasonable, so just like in the system buried the a not time bombs, system and this may collapse at any time. So power supply module design must be very carefully, to ensure the stability of the system.

Choose the 12.1 V power battery, as power sources. Through the related power conversion chip conversion as the processor and the voltage required each sensor.

PCB design and implementation

Due to time relationship, the subject and the four rotor of the flight vehicle concentration control algorithm, most of the modules chosen device finished product, soft in through the multi-purpose after board of the connection, not directly out of PCB board