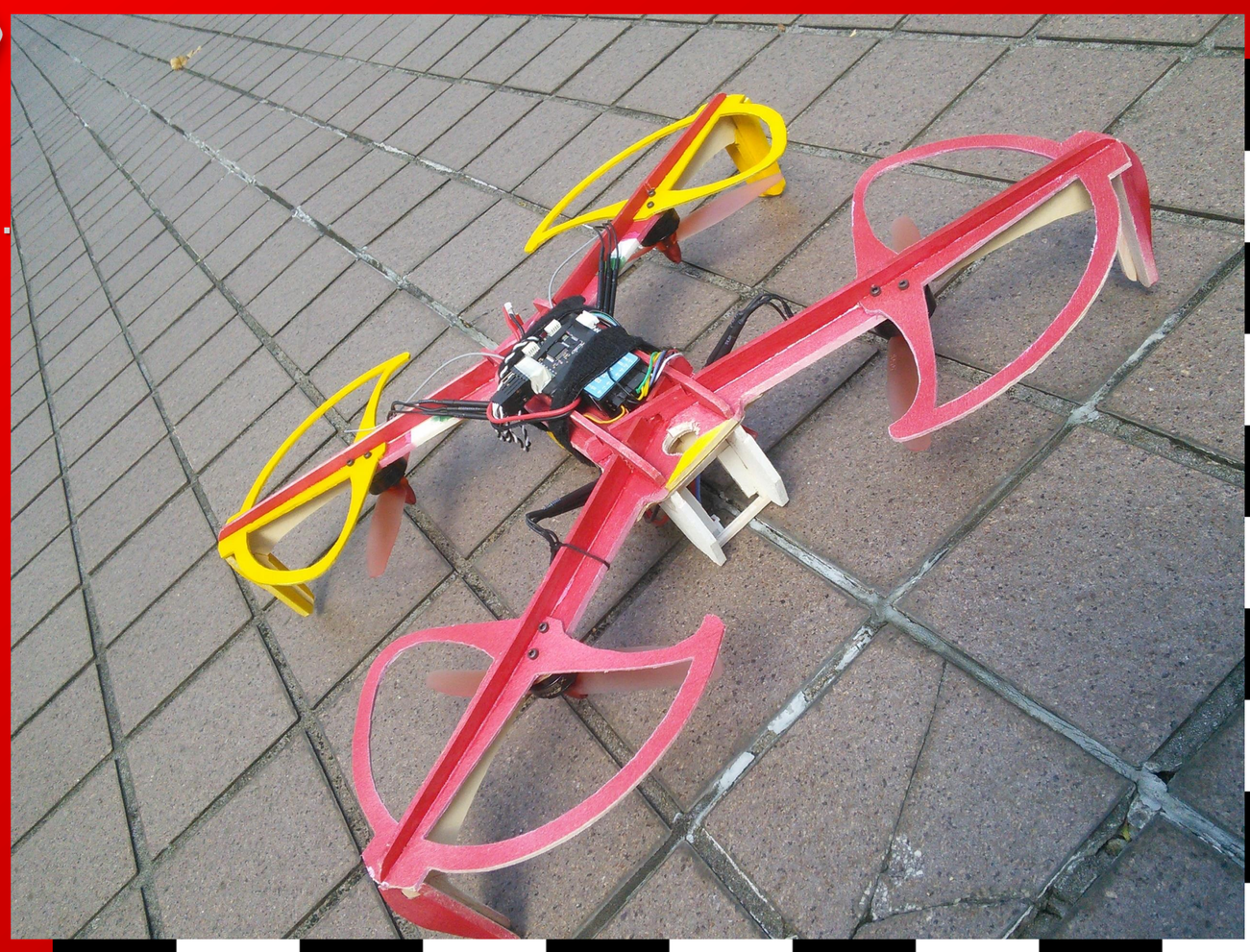
TOKAI

spider

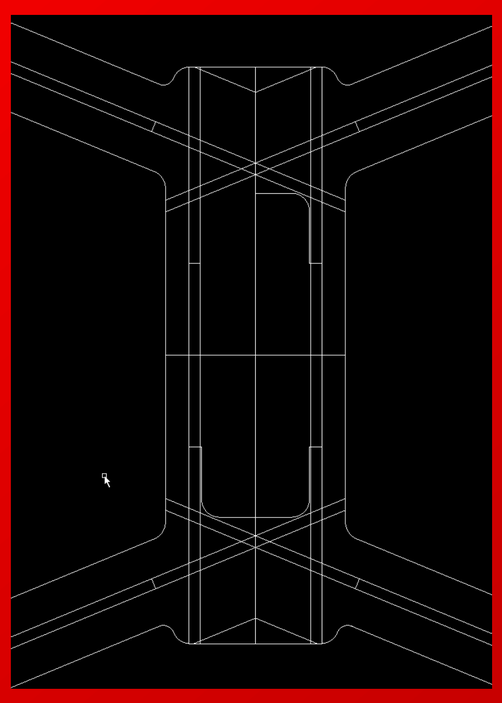
東海大のでかちゃれ DekaChalle

Concept

The ordinary quadcopter design is now uninteresting. Of course it is based on certain methods and past results. In this opportunity, we approached completely unique style and created spider.
A New Type of Airframe.



Structure



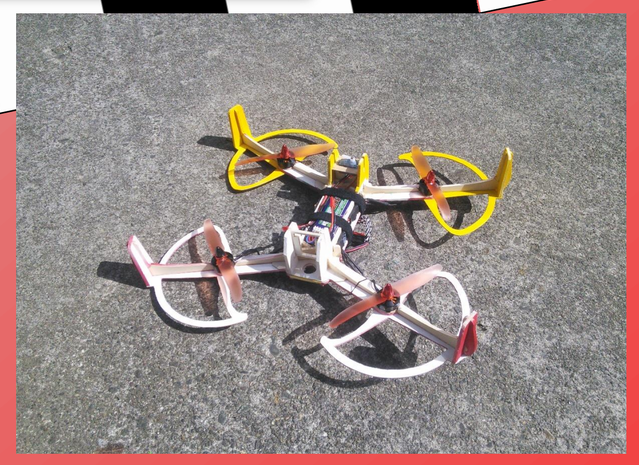
-Hexagon Frame
This structure allows spider extremely tough. Each balsa and plywood parts are strengthened by organized.

-Puzzle Structure
We considered wood fiber problem. All fiber's direction are optimized.

Specification

Length(mm)	415
Height(mm)	150
All-up weight(g)	285
Frame weight(g)	63
Flight duration(min)	4
Max Thrust(g)	330

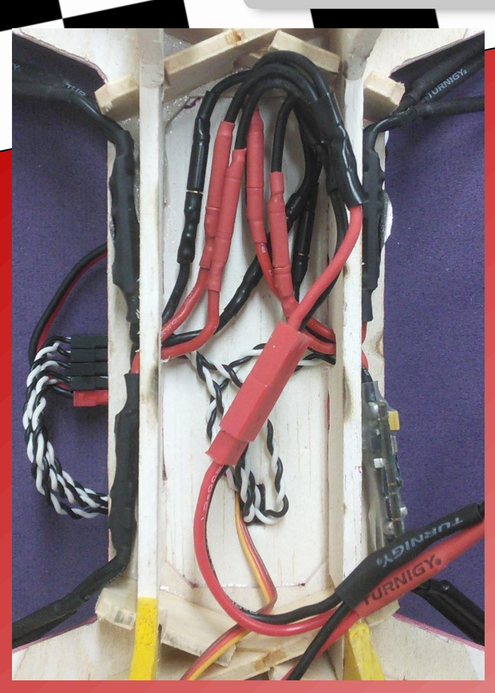
Safety



-Reversed Motor
The greatest features of the spider. This looks aggressive but this is safety factor. Because of this, Propeller Will Not be Flown Away!

Moreover, when it drop to ground its arms protect propellers from collision.
No One Can be Injured by Propeller fragments.

Electronics



-Maintainability
In a process of development we faced many difficulties. Especially, electronic troubles caused us great pain.
All electronic parts connected by gold connector so we can install, remove and exchange these parts easily .

Powered by Tokai University

HORQ

TOKYO METROPOLITAN COLLEGE OF INDUSTRIAL TECHNOLOGY.

MEMBER:
RYO KUMEDA (LEADER) / YUKI OGASAWARA (PILOT)
HIROKI ISHITSUKA / SHIN KIDANE / TAKUMI SAITO

AIR FRAME COMCEPT

DRONE has a lot of possibilities. For rescue, nature research, deliver, and so on. However, unfortunately, every civilians doesn't have good impressioin for DRONE especialy Multicopters. That's why, a lot of accident has occurred in these days for real. I do think that this fact is really tragedy. Therefore, we sat a high value on safety in both of circuit and structure.

HOW TO DESIGN

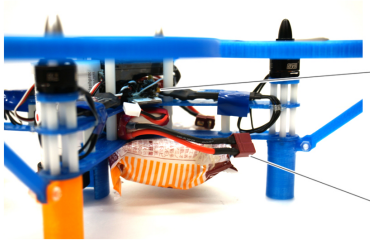
We designed it with know-how came from other Quadcopter for Aerial photographing which is in the project we are going on now. We choose and designed every parts considered with Battery power, Motor current, flying time, and also these weight, and how to gain the best performance.
We used one of 3D-CAD software that called Autodesk inventor. Making it less than 300g is really hard, but we did it.

QUADCOPTER EXPLNATION

BLUSHLESS MOTOR
<DYS 1306-3100KV>
RPM/V: 3100kv
Dimensions: 18 × 15mm
Voltage: 2S~3S (7.4v to 11.1v)
Weight: 13g
Max Current: 8A

ABS PROPELLERS
<Gemfan 5040>
Size: 5040 (5x4)
Hub: 5mm
Material: ABS

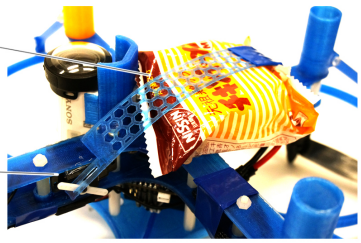
ESC
< xrotor10a>
Current: 10A
Max current: 15A
Li-po Battery: 2-3s
weight: 6.5g



FLIGHT CONTROLLER
<NanoWii ATmega32U4>
6 RX inputs
6 HW PWM
Up to 8 motors or servos

LI-PO BATTERY
<KYPOM K6 7.4V 850mA>
dimension: 58×30×16mm
weight: about 52g
voltage: 7.4V
capacity: 850mAh, 35C (29.75A)

RELIEF GOODS
<Chicken Ramen>
Overview: So delicious
Energy: 400 kcal



SERVO MOTOR
<ZS-F135>
dimension: 58×30×16mm
weight: about 52g
voltage: 7.4V

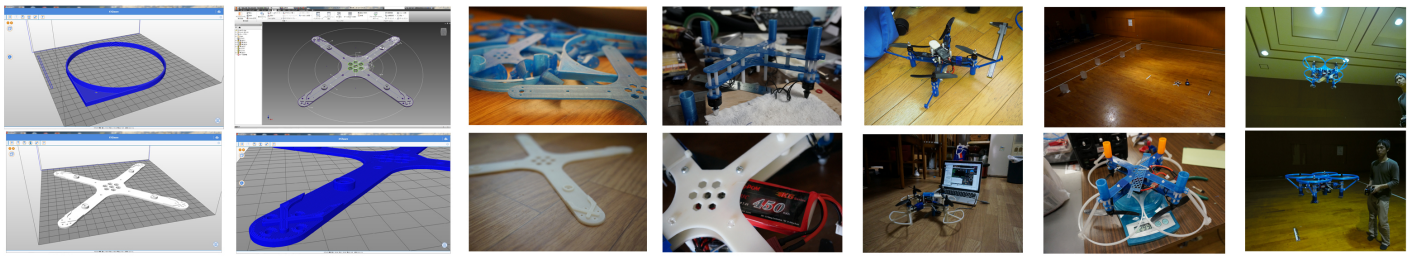
ULTRA-HIGH BRIGHTNESS LED
<OSG58A5111A>
Vf : 3.1v
Iv : 45000mcd
λd : 525nm

WI-FI CAMERA
<HDR-AZ1>
DIMENSIONS: 24.2 x 36 x 74 mm
WEIGHT: 63g
SENSOR TYPE: Exmor R™ CMOS sensor
EFFECTIVE PIXELS (VIDEO): 11.9MP

ABS-FRAME
Overview: Almost 3D printed frame.
Material: ABS
Printer: Da vinch

TRANSMITTER
<Futaba 10J>
Frequency: 2.4GHz
Channel: 8ch

DEVELOPMENT PROCESS



Designing 3D-CAD software Autodesk Inventor → Structure checking and temporary Assembling → Assemble, Redesign try and error → Flying test, practicing for contest

CONSIDERATION TO SAFETY

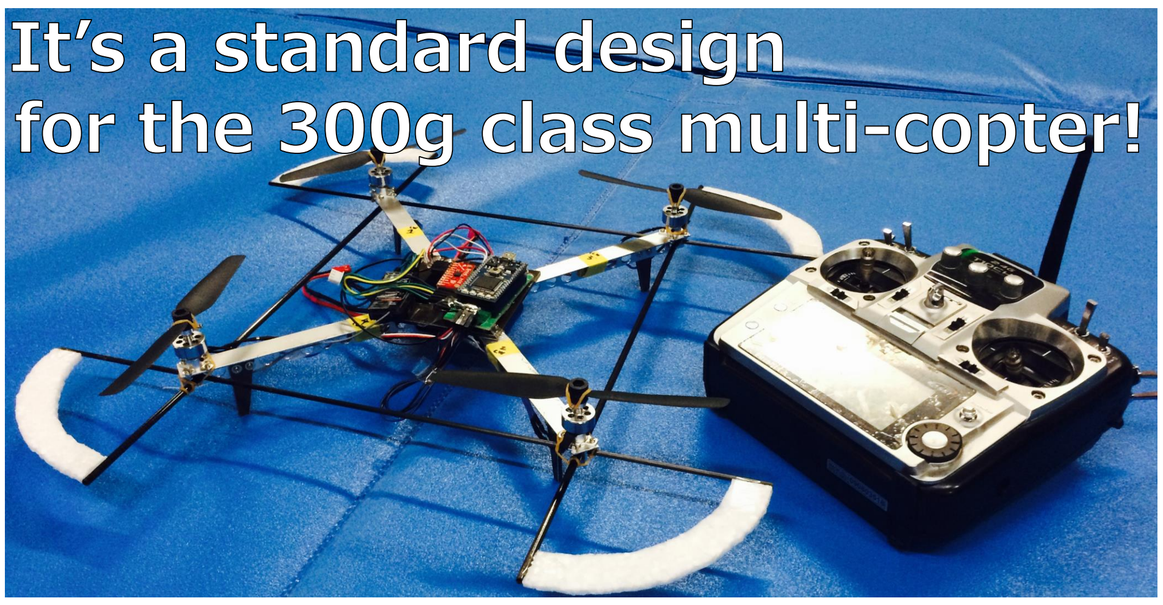
We created a propeller-guard which can cover whole circumference completely. And also, we designed it roundish shape to avoid risk when it hit somewhere. In other hand, not only structure design, we also considered electric circuit. We choosed enough capacity of ESC and cables to avoid risk of catching fire.

OUR ENTHUSIASM

In these days, DRONE that's like Quadcopter is really hot technology in a lot of industry. Now we do think that this technology shall be used for any disaster site. Of course, already many peoples also has this idea. But it's not enough. Because of some accidents, japan looking backward about DRONE. So we want every one to know how good thing is DRONE through events like this.

YAL BEST A DRONE

Produced by Yokohama National University



Supervisor: Prof. T. Higuchi
Sponsor: K. Hoshino, R. Yumoto, S. Agawa
Members: T. Yamamoto, T. Yokoyama,
G. Tanaka, D. Toratani

➢ Concepts

This multi-rotor is developed to aim a standard design for the 300g class multi-rotor.

➢ How to design

The multi-copter is designed by using eCalc. The eCalc is the most reliable RC Calculator on the Web.

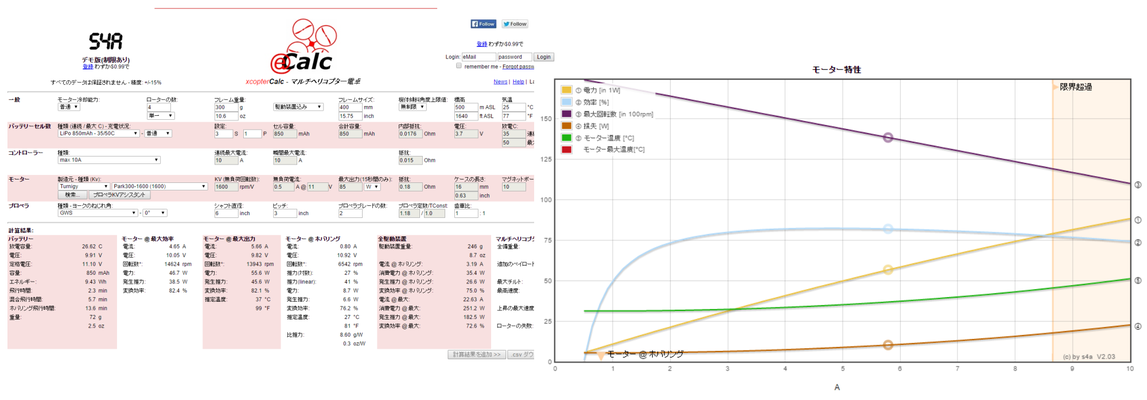


Fig. 1 Display of the eCalc

➢ For safety

The multi-copter has the propeller guard which is composed of the carbon rod and the EPP. The guard is attached on the body by rubber bands to absorb shocks works as a damper.

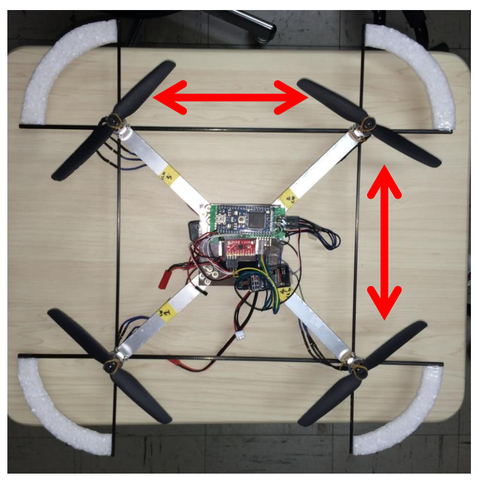


Fig. 2 Propeller guard

The multi-rotor has the 3 flight modes as Disarmed, Manual, and Auto (Rocking wings) mode. With the disarmed mode, the motors don’t spin for safety.

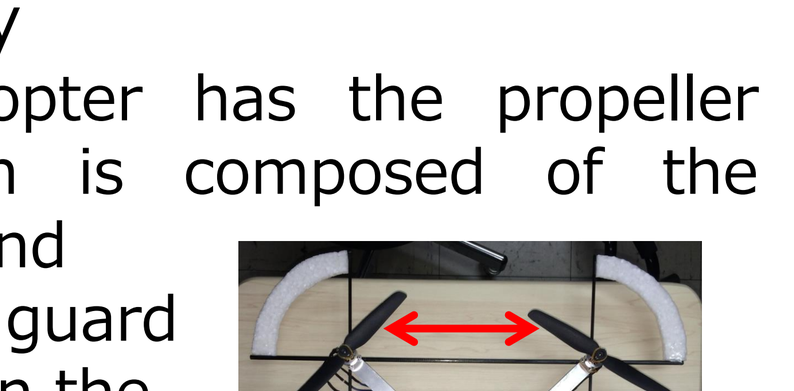
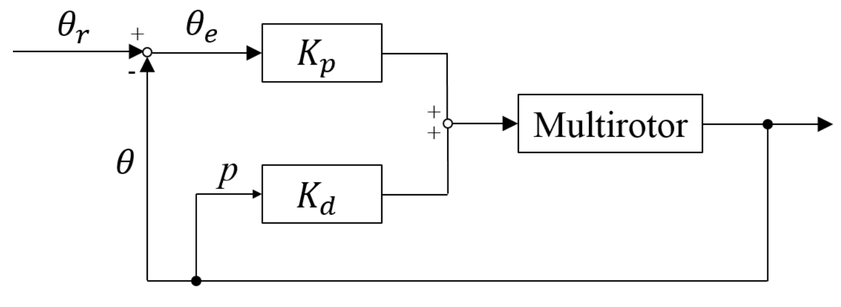


Fig. 3 Flight modes

➢ Flight controller

The flight controller is composed of the microcontroller (mbed LPC 1768) and the 9-axis sensor (gyro, accelerometer, and compass). The sensor measures the angular velocity and the acceleration. The microcontroller estimates the attitude angle of the aircraft and calculates the appropriate motor thrusts to stable the attitude angle. Fig. 4 shows the block diagram of attitude control.



θ: Attitude angle p: Angular velocity
K_p, K_d: Gains $_r$: Required $_e$: Error

Fig. 4 Block diagram

➢ Originality

All components (body, circuit, and program) are developed in our laboratory.

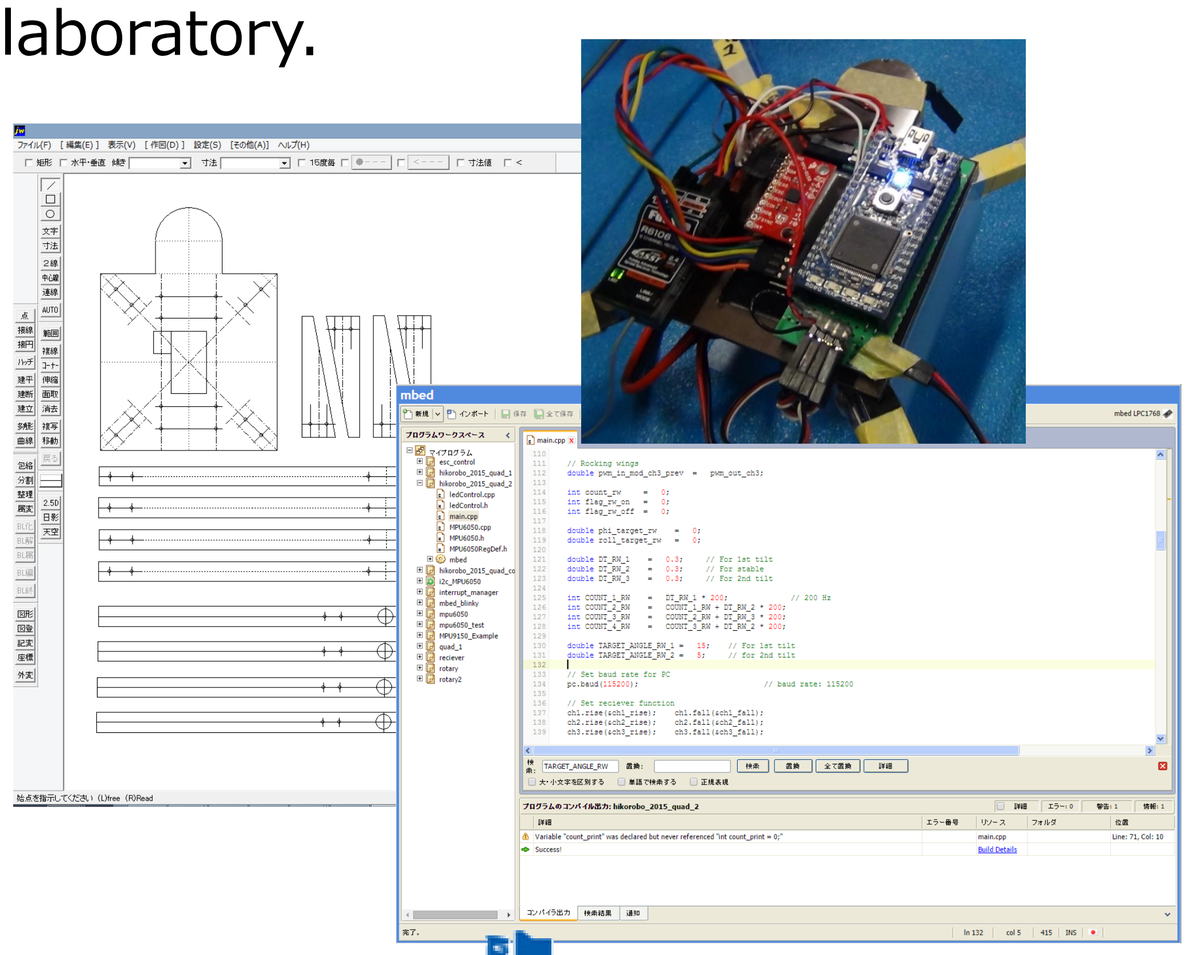


Fig. 5 Our components (Left: Blue print of the body, Upper right: Circuit of the flight controller, Lower right: Source code)

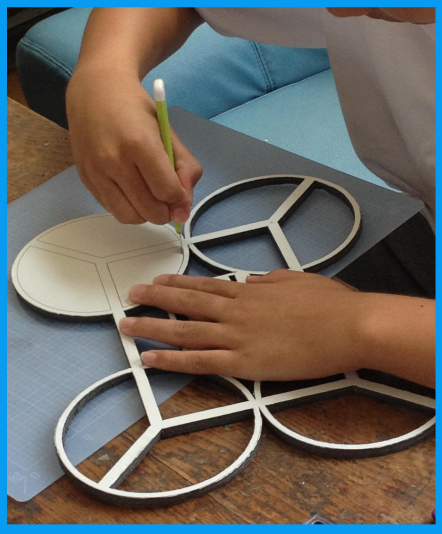
Umidori

Concept
Flying force of seabird

We made the airframe and propeller guard in plastic cardboard.

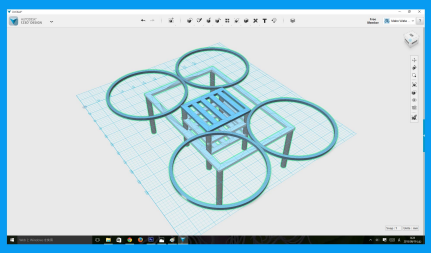
The weight of the body is within 40g.

How you do made this?
The drawing is produced by CAD, and printing and paste it on the material, cutting and assembled.



How did you design?

It was a design by CAD.

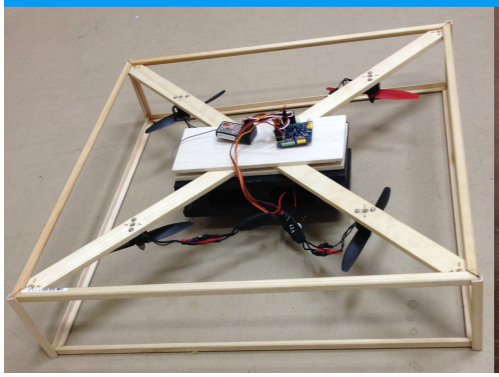


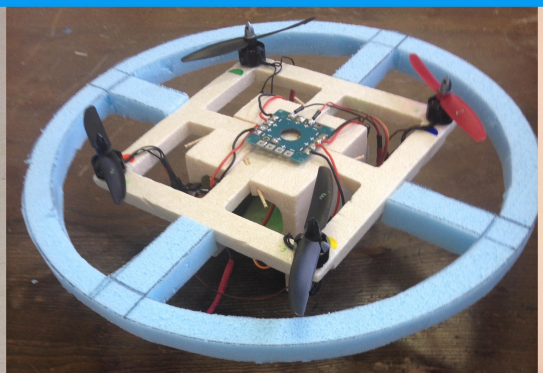
Safety
It was the protection of the propeller by the propeller guard.

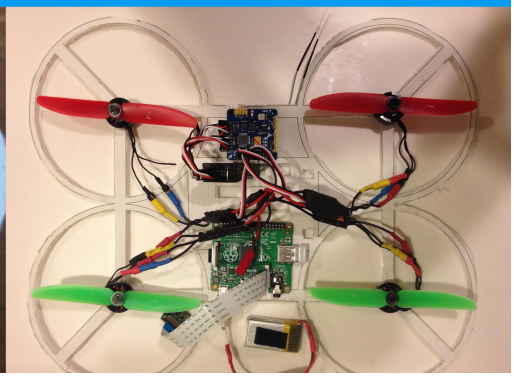
BASIC SPECIFICATION

WIDTH 360mm
HEIGHT 130mm
WEIGHT 298g

Umidori was completed by a lot of challenges and a lot of failure.







Team Name：SAKVEI（サクベイ）

Katsuhiro Suzuki, Hiroki Bingo, Mizuki Hayashi
Kyushu Institute of Technology

Concept

The concept of our aircraft is higher flexibility because the rescue robot which is the theme of this convention should work in various condition (wind velocity ,weight , path length).

Flexible arrangement and spacing.
Even though the convention rule or condition changed on the occasion of designing, the airframe can be easily changed.
Making free space often falls into making bloated or superfluous design.

- **A layered structure**
- **Spacing with stairwell**
- **Weight saving by CFRP**
  （Thinning structure in high strength）

Safety

- **Setting formed styrol propeller guard**
- **Safely landing in blackout**

Feature

- **String traction system was Adopted to transport goods.**
  - **This system can handle the goods bigger than the airframe or various goods shape and get stability by changing binding method.**
  - **The blue section is the place to hang strings on fig 4.**

Fig 3. finished quadcopter

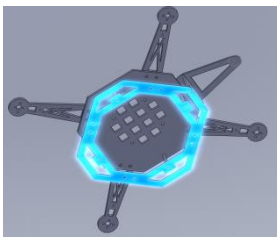


Fig 4. the bottom of airframe

Designing method

1. **Designing on paper in accordance with the rule(fig 2）**
2. **Settling the specifications**
3. **Using CAD（Solid Works)**
4. **Simulation the weight**
5. **Improving by sharing CAD data**

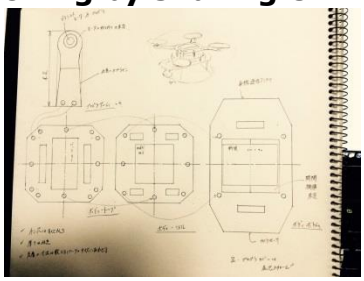


Fig 1. a concept design

Making method

- **Processing CFRP by using CNC （fig 2）**
- **Making propeller guard by using formed styrol cutter**

Fig 2. CNC

FPV

- **Obtaining the license of 4 grade amateur radio**
- **Using 5.8GHz spectrum**
- **Opening radio station**
- **The Image delay of FPV is shorter than Wi-Fi camera**
- **The application takes about a month**
- **Not installing on this convention**

Fig 5. a transmitter

Univ. Tokyo Quadcopter
Uppsala

Produced by
Soichiro Iwataki　Hiroyuki Karasawa
Shunsuke Imaizumi　Shuhei Yamada

Powered by

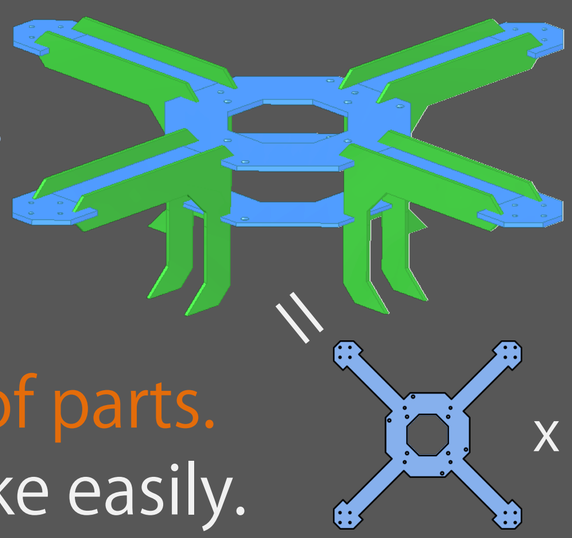
BOEING　東京大学 THE UNIVERSITY OF TOKYO

Concepts & Features

- **Easy to Adjust**
  - Simple & Strong Structure
  - Self-making Control System
- **Safe Design**

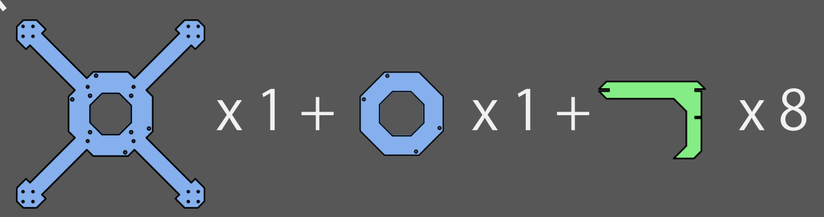
Structure

High Strength & Light Weight
- Main Structure is 3-Layer Structure.
- Each Motor arm has 2 Libs.



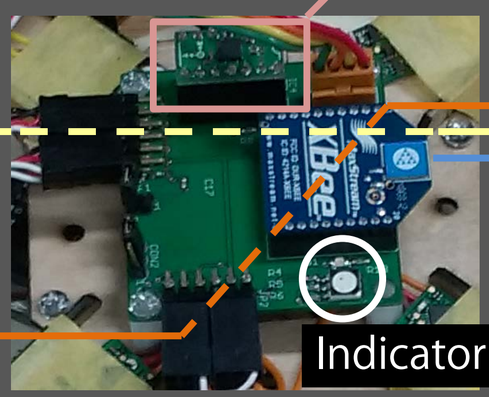
Layer Composition
Top : Control board
Mid : Battery & Receiver
Bot : Relief goods

Simplicity
- Main Structure consists of 3 types of parts.
  …It enables us to assemble & remake easily.



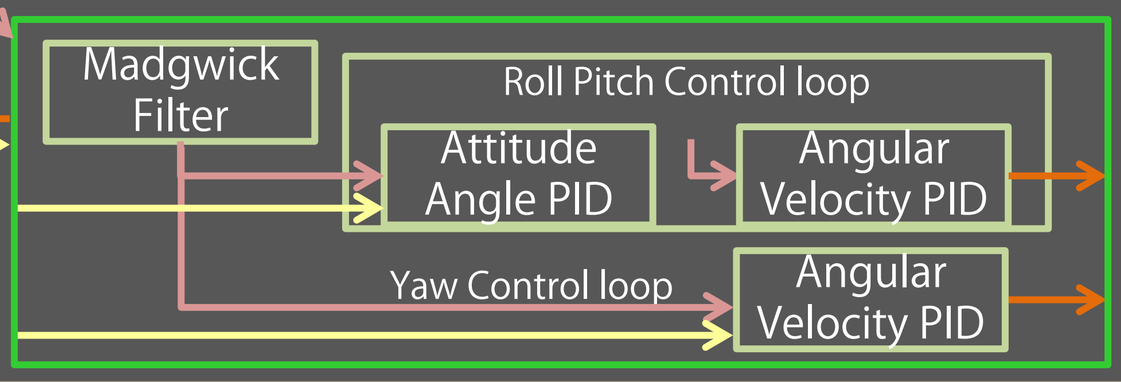
Control System

Self-making & Easily Programmable Control Board



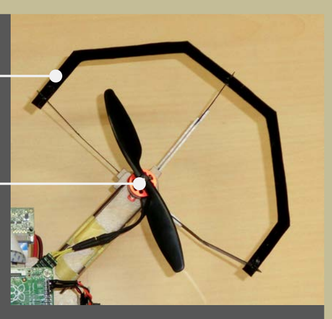
Control Algorithm

State Estimation: Madgwick Filter
Controller: PID
@Microcontroller : STM32F401



For Safety

Propeller Guard
Each Propeller has Flexible Guard.



Unmistakable arm system
To arm Quads, prescribed input is required.

Fail Safe Mode
When commands are lost, Quads disarms.

Other Specification

Measurements

✓ Width x Height	340 mm x 110mm
✓ Empty Weight	295 g

Equipment

✓ Propeller	5 inch x 3 inch
✓ Motor	2900 KV Brushless
✓ Battery	Li-Po 2S 850mAh
✓ Camera	Raspberry Pi A+