

MASTER'S IN AEROSPACE ENGINEERING  
PROJETO AEROESPACIAL

University of Minho  
School of Engineering

# **RECONSTRUCTION OF THE AVIONICS SYSTEM OF THE HANGAR 9 SOLO TRAINER AIRCRAFT**

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# SYSTEM DEFINITION AND REQUIREMENTS

## MAIN MISSION

Develop the avionics system for the UAV (Unmanned Aerial Vehicle) Hangar 9 Solo Trainer.

## REQUIREMENTS

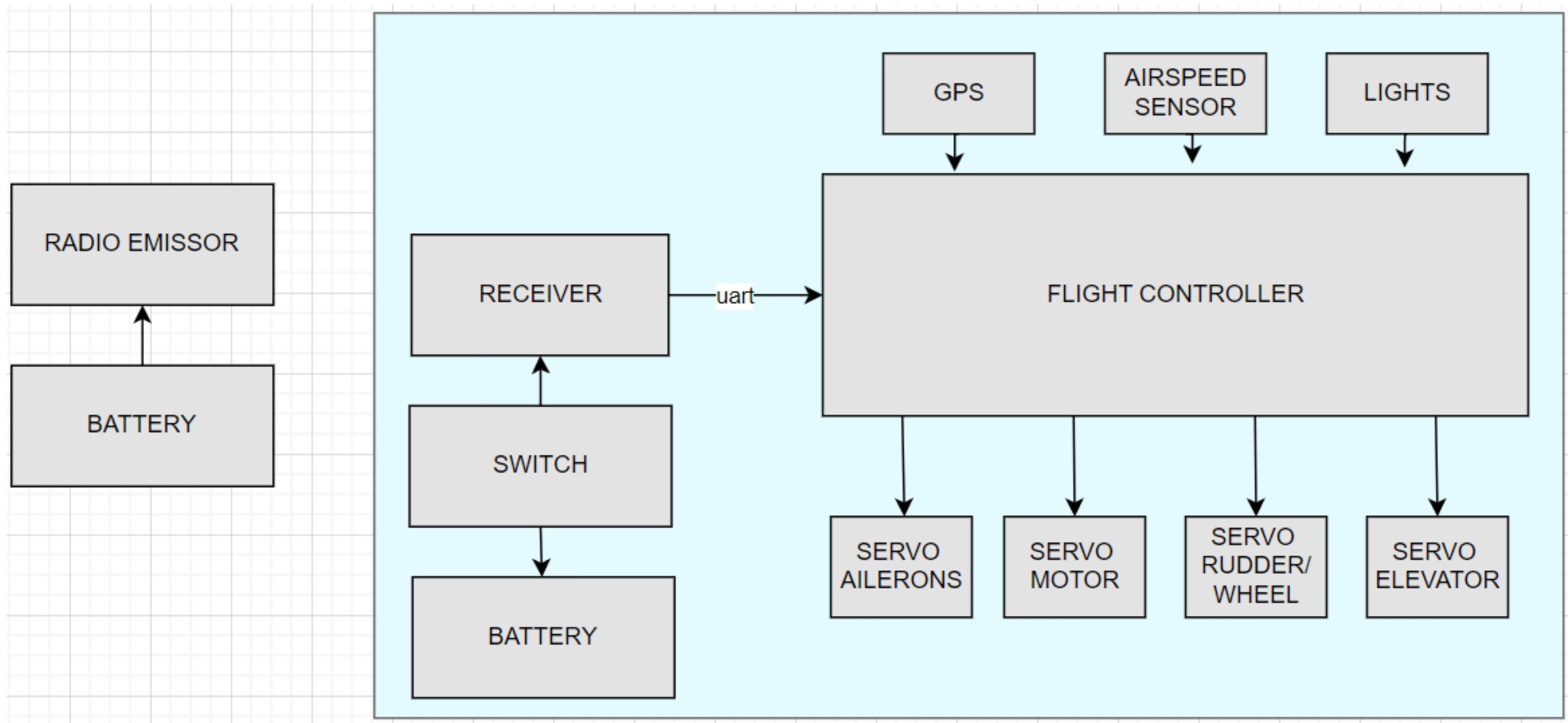
ALL THE AXIS  
MOVEMENTS OF THE  
AIRCRAFT ARE  
WORKING

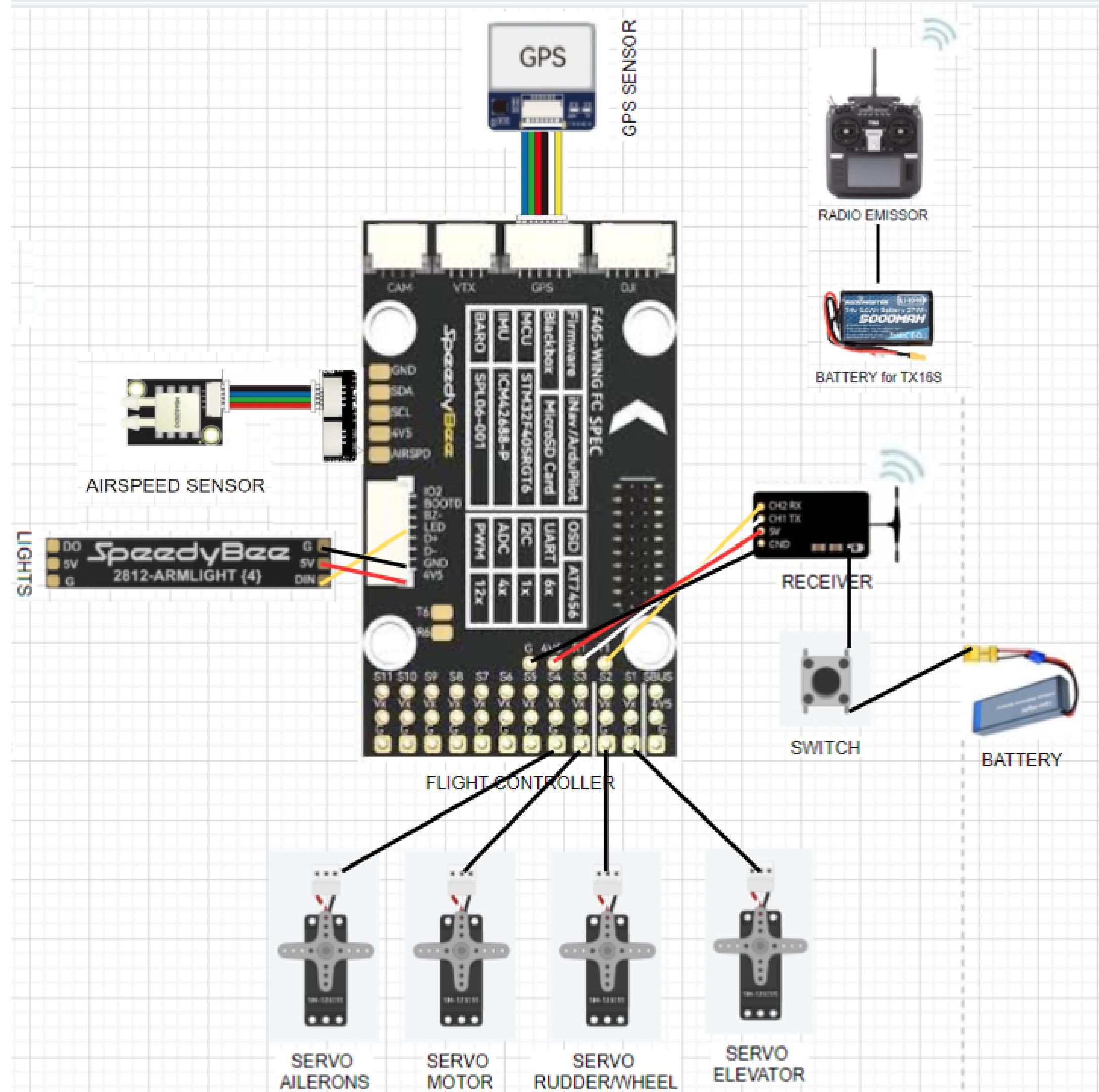
INTEGRATES A  
WIRELESS  
COMMUNICATION  
SYSTEM (RADIO), FOR  
EFFECTIVE REMOTE  
CONTROL

TRANSMITS REAL-TIME  
DATA SUCH AS  
BATTERY PERCENTAGE,  
ALTITUDE, LOCATION  
AND MOTOR RPM

ALL COMPONENTS  
ARE COMPATIBLE  
WITH EACH OTHER

# SYSTEM ARCHITECTURE AND COMPOSITION





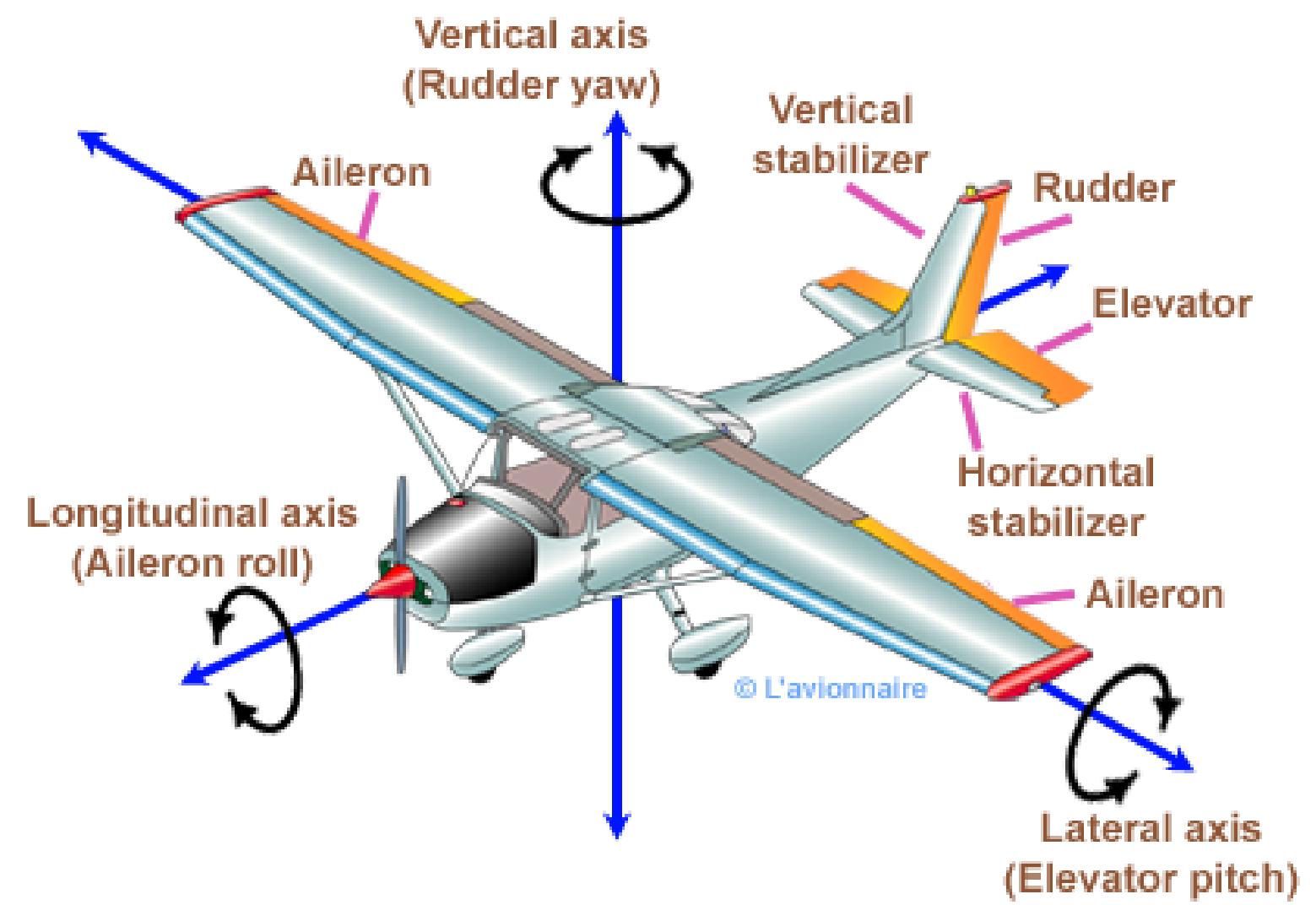
# COMPONENT DESCRIPTION



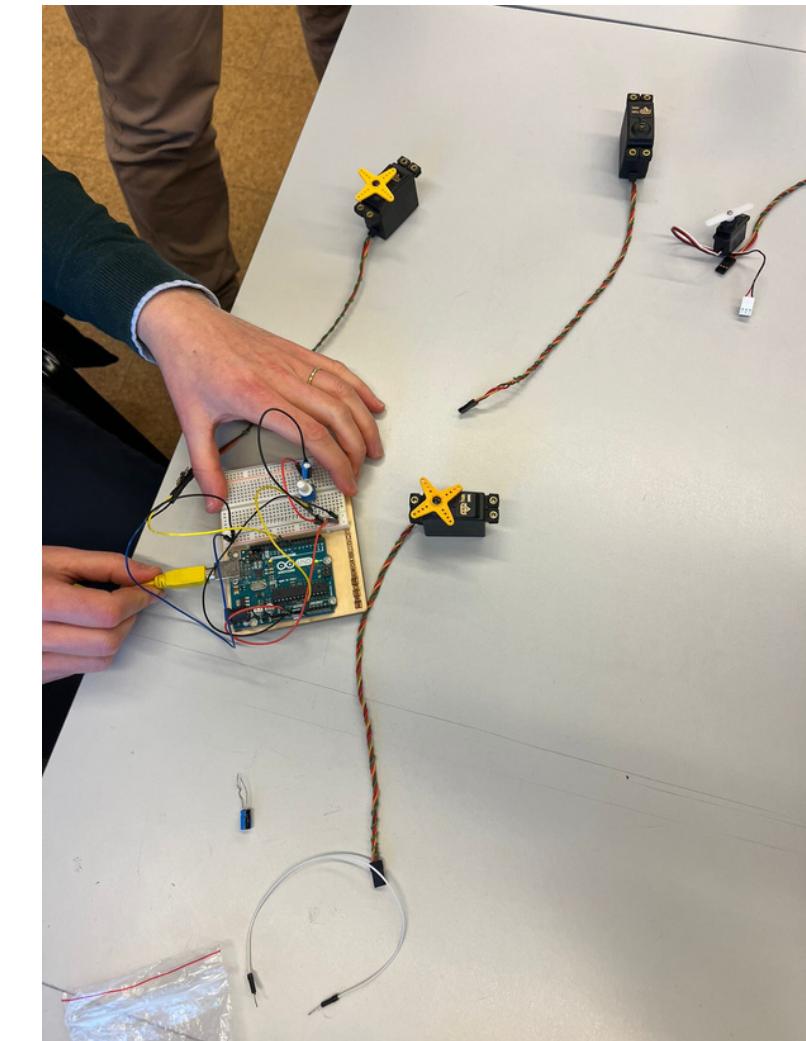
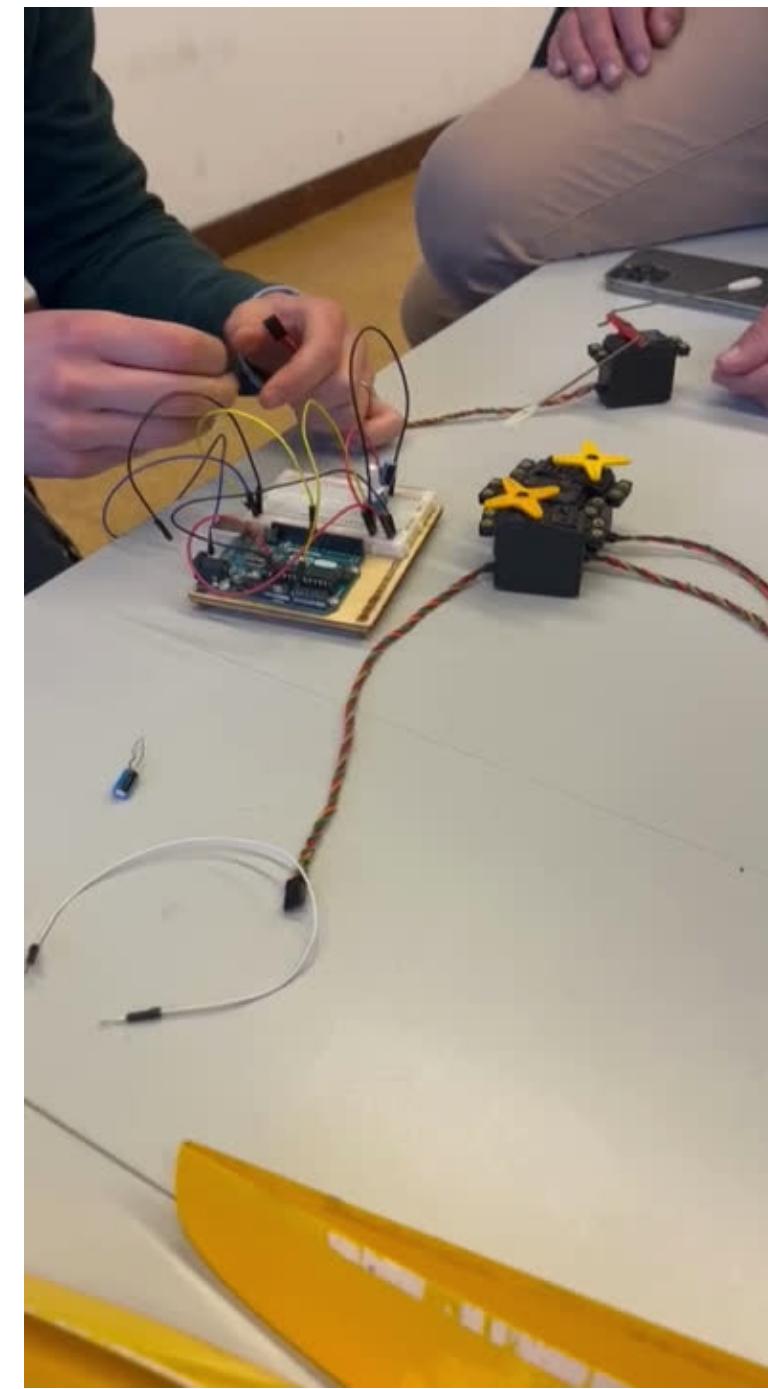
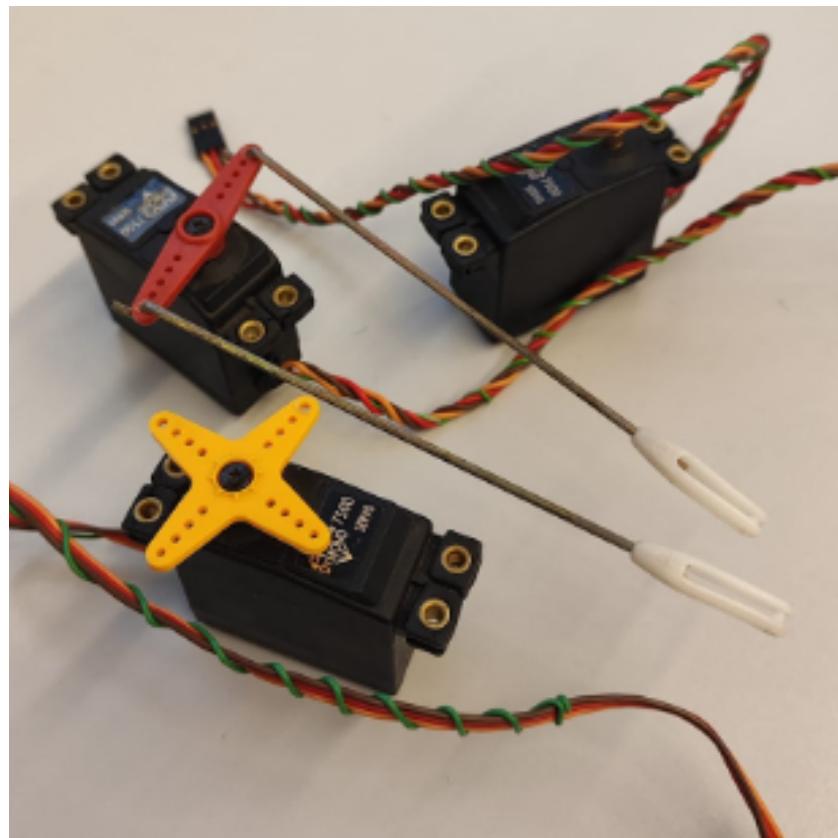
# SERVOS

Small motors that translate electrical signals from the flight controller into mechanical movement of the:

- Ailerons;
- Rudder or Wheel;
- Elevator;
- Motor.



# SERVOS



# CONTROLLER

Interprets the inputs from the pilot, and then generating appropriate signals to control the various components of the aircraft.

- **Fundamental Characteristics:**

- ELRS.
- Low-latency and long-range communication between the controller and the receiver.

- **Ideal Model:**

- *"TX16S Mark II Radio Controller"* from Radiomaster.



# RECEIVER

Receives control signals from the transmitter operated by the pilot;

Decodifies the signals and sends them to the flight controller, who interprets them to adjust the aircraft control surfaces.

- **Fundamental Characteristics:**

- ELRS.
- PWM (Pulse Width Modulation).
- 6 channels.

- **Ideal Model:**

- “ER6 2.4GHz ELRS PWM” from Radiomaster.



# BATTERY FOR CONTROLLER

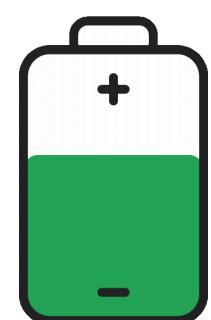
Responsible for powering the controller.

- **Fundamental Characteristics:**

- LiPo battery.
- XT30 connectors.
- Compatible with the radio emissor.

- **Ideal Model:**

- *"21700 5000mAh Battery for TX16S and TX12S MKII"*  
from Radiomaster.



# ONBOARD BATTERY

Responsible for feeding the electrical system of the aircraft.

- **Fundamental Characteristics:**
  - LiPo (2-6S).
  - XT30 connectors.
  - Able to feed the whole system.
- **Ideal Model:**
  - “2S 7.4V 6200mAh Lipo Battery” from Radiomaster.



# BATTERY CHARGER

Responsible for recharging all the batteries.

- **Fundamental Characteristics:**
  - Compatibility with the batteries.
- **Ideal Model:**
  - “S100 1x100W USB-C Smart Charger” from Spektrum Smart.

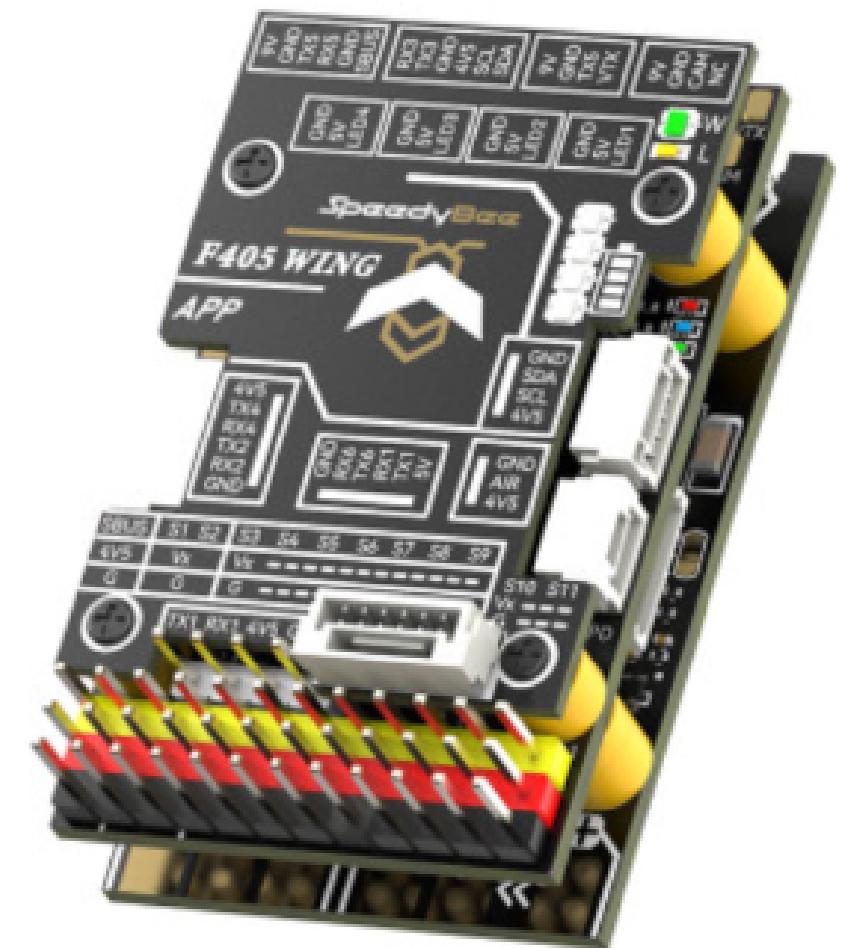


# FLIGHT CONTROLLER

Receives input signals from the receiver, which is connected to the controller operated by the pilot.

Processes these signals, and calculates the necessary adjustments to the control surfaces to achieve desired flight characteristics, and sends commands to the servos.

- **Fundamental Characteristics:**
  - Compatibility with the receiver.
  - Compatibility with Ardupilot and INav.
  - Allows the connection with various sensors.
- **Ideal Model:**
  - “F405 WING APP Fixed Wing” from SpeedyBee.



# SWITCH

Manually controls the flow of electricity.

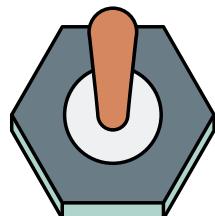
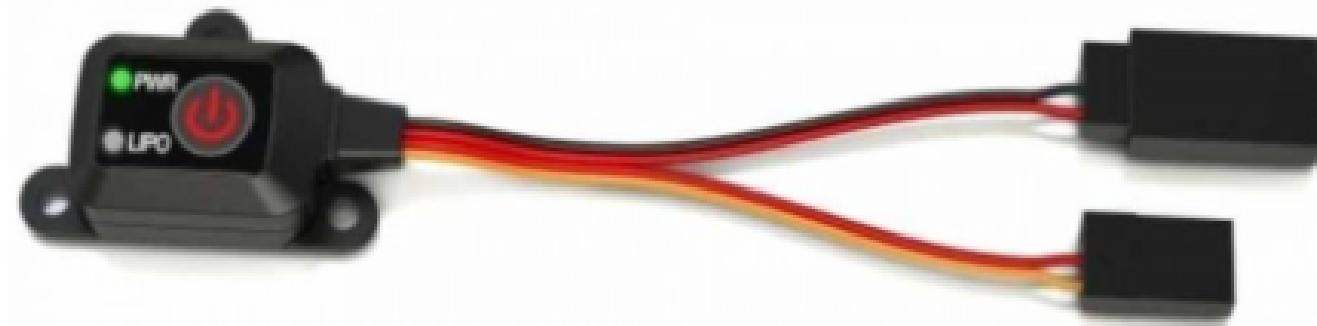
Connected to the receiver and to the battery.

- **Fundamental Characteristics:**

- XT30 connectors.

- **Ideal Model:**

- *“Digital Switch”* from SkyRC.

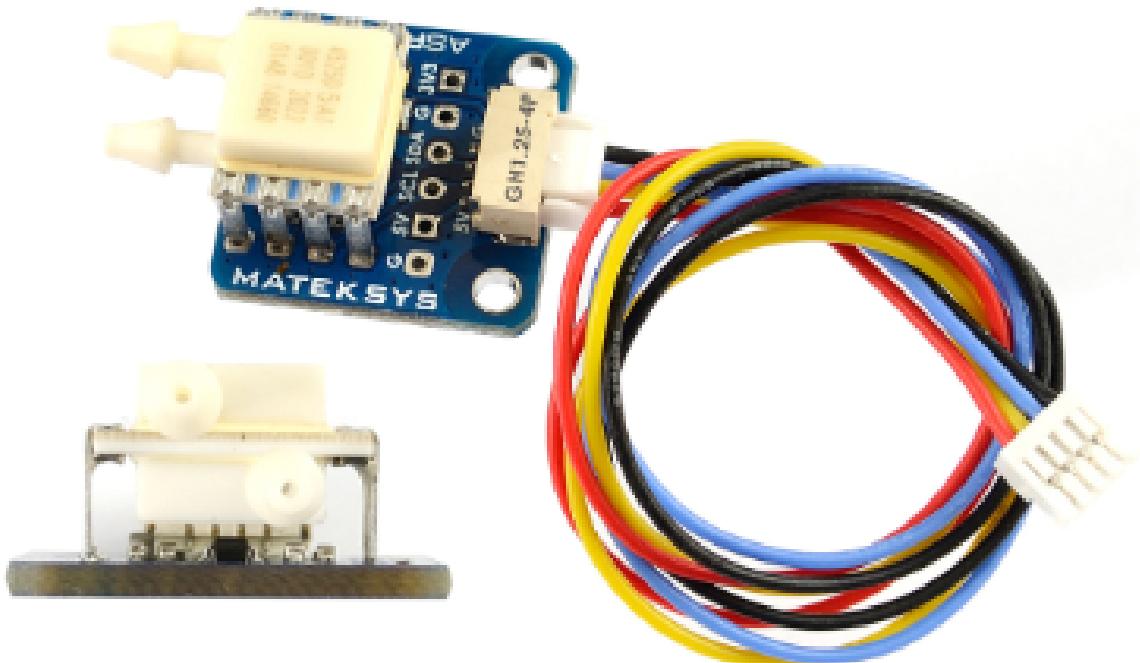


# AIRSPEED SENSOR

Measures air speed, providing crucial data to pilots to monitor, control and navigate the aircraft.

Detects changes in air pressure, airflow disturbances or the time it takes for sound waves to travel through the air.

- **Fundamental Characteristics:**
  - Compatibility with the Flight Controller.
- **Ideal Model:**
  - “ASPD-4525” Airspeed Sensor from Matek.



# GPS SENSOR

Enhances navigation, stability, and control of the RC aircraft.

Provides essential data for safe and effective flight operations.

- **Fundamental Characteristics:**

- Compatibility with the Flight Controller.
- Compass integration for orientation and heading sensing, aiding navigation.

- **Ideal Model:**

- “BZGNSS BZ-251 GPS with 5883 Compass” from SpeedyBee.





# LIGHTS

Increases visibility, safety and aesthetics.

- **Fundamental Characteristics:**
  - Compatibility with the Flight Controller.
- **Ideal Model:**
  - “Programable 2812 Arm LEDs (4 Pcs)” from SpeedyBee.

DO 5V G  
5V G  
G 2812-ARMLIGHT {4}

# SCHEDULE

# **RESTRICTIONS AND CONCERNS**



TIME OF  
ACCOMPLISHMENT  
OF ALL THE PHASES

LIFE TIME OF THE  
BATTERIES

THE AIRCRAFT'S  
WEIGHT AND GRAVITY  
CENTER

COMPATIBILITY  
BETWEEN THE  
COMPONENTS

BUDGET

BAD WEATHER

TIME OF ARRIVAL  
AND CHOOSING OF  
THE COMPONENTS

POOR  
COMMUNICATION  
BETWEEN THE  
RADIO AND THE  
RECEIVER







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