# CORONE TEAM

# **Drone It Yourself!**

MAKING AND DESIGNING A TOY DRONE THROUGH MULTIDISCIPLINARY COLLABORATIVE WORK Project no. 2015-1-ES01-KA202-015925



Co-funded by the Erasmus+ Programme of the European Union



Drone It Yourself! consists of the following modules:

0. INTRODUCTION TO THE DRONETEAM PROJECT

- 1. BASIC TOY DRONE FRAME
- 2. MODULE OF FLIGHT CONTROL
- 3. MODULE OF COMMUNICATION CONTROL
- 4. MODULE OF ADVANCED FRAME

5. MODULE OF GPS-COMPASS CONTROL

6. MODULE OF PROBLEM MANAGEMENT

- 7. MODULE OF FLIGHT STABILIZATION SYSTEM
- 8. MODULE OF FIRST PERSON VIEW

9. DRONETEAM E-LEARNING PLATFORM

**10. OTHER DEVELOPMENTS** 

11. GLOSSARY

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## MODULE OF PROBLEM MANAGEMENT

2015-1-ES01-KA202-015925





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# Index

1.	POV	VER MODULE	. 2
2.	APN	1 2.6 PROBLEMS	. 3
3.	DRO	DNE REGULATION	18
	3.1.	Regulations in Spain	18
	3.2.	Regulations in Slovenia	20
	3.3.	Regulations in Poland	20
	3.4.	Regulations in Croatia	21



## **1. POWER MODULE**

Power module permit measure current consumption and provides a stable voltage. It allows triggering a warning when battery is near of its capacity or there is a power problem.





Power module with TX60 connectors to connect the battery and the PBD (control distribution plate).

The power or power module will allow to know the voltage and the current supplied by the battery. These data can be viewed through live telemetry or data stored in the flight control of the drone.

A unique 6-pin cable is suitable for APM, HKPilot or PX4 controllers.

In this case, it also has a built-in switched BEC that emits 5.3V to a maximum of 2.25A, and can use up to 45Volts (10S LiPo) and up to a maximum of 90 A.

However, for The feeding of the motors is necessary an adequate PBD to avoid power problems.

The system is complemented by a "sneak" that emits a sound when the battery is running low, so the pilot can land the drone safely avoiding accidents due to battery exhaustion.





## 2. APM 2.6 PROBLEMS

How to program APM 2.6 on Atmel 2560

#### Introduction

APM 2.6 is preprogramed board. This is made for working with ArduPilot without any errors. The chip is Atmel 2560.

#### Configuration

- Windows 10 64bit
- Asus ux32a
- USB 3.0
- SSD
- Intel Core i3-3217U 1.80GHz
- 4 GB RAM

#### How it happened?

We decided if It works with Mission Planner, we will try with Arduino. Probably something went wrong during loading settings. This is very popular problem with APM 2.6, but few people have resolved this problem.

#### Symptoms

- Device is visible in COM port
- Only green led lights
- In mission planner it is impossible to connect and write new firmware
- Generally, device works

#### How to connect APM to Arduino

These steps will show you how to configure Arduino under APM

#### Install Git-SCM

1. Download and run the install file from: http://git-scm.com/download/win 2. Follow the screenshots below to make your selections during install.

	Welcome to the Git Setup Wizard
	This will install Git version 1.8.4-preview20130916 on your computer.
	It is recommended that you close all other applications before continuing.
	Click Next to continue, or Cancel to exit Setup.
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	Next > Cancel





## Install MHV\_AVR\_Tools to its default location %

1. Download and install the MHV\_AVR Tools: http://firmware.ardupilot.org/Tools/Arduino/MHV\_AVR\_Tools\_20121007.exe





Menedžer urządzeń
lik Akcja Widok Pomoc
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⊳ 📲 Urządzenia systemowe





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#### How to repair board?

You must put bootloader again by usbasp programmer.

#### What do you need?

- Some knowledge about programmers and microcontrollers
- USBASP or AVR programmer
- Transfer cable
- KANDA adapter (if you have a 3 pins board)
- Application or AVRDUDE



#### USBASP



#### Cable





#### **KANDA Adapter**



Pins





ATmega32	∠ j ● Lista ○ Lista	a krótka LOW a pełna 0x E1		GH EXTEN		ustaw 0x	3F	
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ATmega2560	Lista	krótka LOW pełna 0x FF	0x D8 0x FD	
Fusy właściwości	Fusy manualnie	Fusy uproszczone	Lock bity	Programator AVR Ustawienia
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Sprawdź po	odłączony AVR	Sygnatura AVR: Nazwa AVR:	1E9801 ATmega256	Po sprawdzeniu przełącz na: nie przełączaj ▼
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-	[Linia poleceń AVRDUDE] ODCZYT z AVR									
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			AVRDUDE arg.	-U lfuse:w	:0xFF:m -U hfu	se:w:0xD8:m	Ue			

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mkAVR Calculator ver.1.0.0 build 59 zarejestrowano dla: Nazwisko Imie [ATmega2560]				
Fusy właściwości Fusy manualnie	Fusy uproszczone Lock bity Programator AVR Ustawienia			
[ Ustawienia AVRDUDE ]         Szybki wybór programatora         Programator         Programator         USBASP         stk200 [lpt1]    Programator          Image: Start of the st				
Sprawdź podłączony AVR         Sygnatura AVR:         1E9801         Po sprawdzeniu przełącz na:           Nazwa AVR:         [ ATmega2560 ]         nie przełączaj   nie przełączaj <td< td=""></td<>				
[ Operacja AVR ]       rodzaj pamięci         ODCZYT       ZAPIS         WERYFIKACJA       V FLASH         Opcje dodatkowe       Otwórz profil				
<ul> <li>D Wyłącz auto kasowanie flash</li> <li>-e wykonaj kasowanie AVR</li> <li>-n nie zapisuj do AVR</li> </ul>	PLASH     pokaz plik hex       m2560.hex        EEPROM     pokaż plik hex			
[Linia poleceń AVRDUDE] ZAPIS do AVR sprawdź podwójnie przed operacją zapisu do AVR				
avrdude -p atmega2560 -c usb	avrdude -p atmega2560 -c usbasp -P usb -V -U flash:w:"C:\Users\Tomasz\Desktop\r			
	AVRDUDE argU Ifuse:w:0xFF:m -U hfuse:w:0xD8:m -U e			



With the previous procedure, we will solve the APM 2.6 problems.



## **3. DRONE REGULATION**

Drone sector is an emerging and technologically advanced sector that is being regulated by all countries, although logically, there is always the circumstance that while the sector is growing in possibilities and applications, the regulations are also adapted to the circumstances. Therefore, the regulations that affect drones or unmanned aerial vehicles will change in the coming years. It is important to know what is the regulation that affects the flight of drones. In this section, a review is made and advice of good practices for the proper use of drones are given. In each country, regulations on drone flight must be met and respected. Not all countries have the same regulations and there are some variations.

### 3.1. Regulations in Spain.

In Spain, for example, the last applicable standard for the closing of this document is published from 18 April, 2018.

According to the weight of the drone we will have more or less prohibitions (this being for recreational use).

If your drone weighs less than 250g, you can fly it practically anywhere except in restricted flight areas and near airports, as long as you do not exceed 20 metres in height and do not bother third parties.

But if your drone exceeds this weight, without reaching 2kg, almost all fall into this category, you have to go to parks or unpopulated areas to use it, since you cannot fly over people or buildings or exceed 50 metres in height.

Next we will see the rules more closely:

#### What requirements do I have to meet if I am flying recreationally?

1. Fly at a minimum distance of 8 km from any airport or aerodrome.

2. Fly out of controlled airspace.

3. Do not exceed 120 metres above the ground, or above the highest obstacle located within a radius of 150 metres from the drone.

4. Fly by day and in good weather conditions. Here it is necessary to emphasise that if the drone weighs less than 2 kilograms, night flights are allowed as long as they do not exceed 50 metres in height.

5. Flights will always be within the visual range of the pilot.

6. Airplanes of less than 250 grams may fly in the city and over crowds of people and buildings as long as they do not exceed 20 meters in height.



7. Although it is not mandatory for recreational use, it is highly recommended to have a civil liability insurance

#### Where to fly:

Next we are going to talk about ENAIRE, the manager of air navigation in Spain.

It is responsible for controlling an airspace of more than 2,000,000 km, in addition to having a website where we can know if it is safe to fly our drone or not in a space defined by ourselves. Link: <u>https://drones.enaire.es/</u>

Within this page, we must answer a few questions about our drone and where we want to fly.

In our case, the drone we use is recreational, so we can only use it for exhibitions or recreational activities.

Once the questionnaire is finished, we will press the button Draw flight area on the map.

As you can see, we are already on the world map, and we can choose the desired flight area, since the page itself will determine whether it is legal or not to fly in that area.

We have chosen the dark circle and, as far as we can see, the page says that there is no flight restriction in the marked area, although in any case, we must also follow the rules of the Law.





### 3.2. Regulations in Slovenia

In Slovenia, there are variations of weights or distances, comparing with the other countries regulations:

- If drone weighs 5 kilograms or more, must be registered in the CAA (Civil Aviation Administration of Slovenia: <u>http://www.caa.si/</u>). For 25 Kg or 150 Kg there are some specific regulations.
- Distance to airports: 1.5 kilometres from airports.
- Only can fly during the day.
- Commercial drone flights are not permitted, only recreational purposes.
- Maximum height: 150 metres.
- Maximum horizontally distance between drone and pilot: 500 meters. FPV flights are permitted if there is a visual point from the pilot to watch the drone.

you can learn the Slovenian drone rules through a video game: <u>http://www.dronbonton.si</u>



### 3.3. Regulations in Poland.

In Poland, the Civil Aviation Authority is the body in charge of regulating the drone sector. To fly in Warsaw is required a special authorization. And commercial pilots must pass some certificates. Therefore, basic rules for flying drones in Poland are:

- Maximum height: 150 metres.
- Maximum weight: 25 kg
- Distance to airports: 5 kilometres from airports.
- Al least 100 metres from over cities and 30 metres from vehicles or animals
- Drone must be in visual line with pilots
- Liability insurance is only required for commercial drones.



### 3.4. Regulations in Croatia.

The Croatian Civil Aviation Agency is the body that organise the drone sector in Croatia. Basic regulations are:

- Maximum height: 150 metres.
- Maximum weight: 5 kg. For more than 5kg, the drone need a label with non-flammable identification and the pilot information (name, address, phone)
- Distance to airports: 3 kilometres from airports (except under special circumstances)
- Only can fly during the day.
- Safe distance: Al least 150 metres from cities or group of people and 30 metres from vehicles, animals, power lines, railways, roads, etc. Avoiding risk to health of people.
- Drone must be in visual line of sight with the pilot, and no more than 500 metres
- Liability insurance is required for drones with 20 kg or more.
- To take photos or record video can only be done by professional and with a special permit.
- Approval for radio frequency spectrum used is required: <u>https://www.hakom.hr/default.aspx?id=596</u>
- There are different areas ready to fly (AREA I –Semi-rural with not elevated structures or buildings; AREA II: Rural areas, farm buildings or structures without people or with people passing occasionally like cyclists, etc.; AREA III: Residential areas; AREA IV: Cities). Leisure flights only are possible in AREA I and AREA II.

