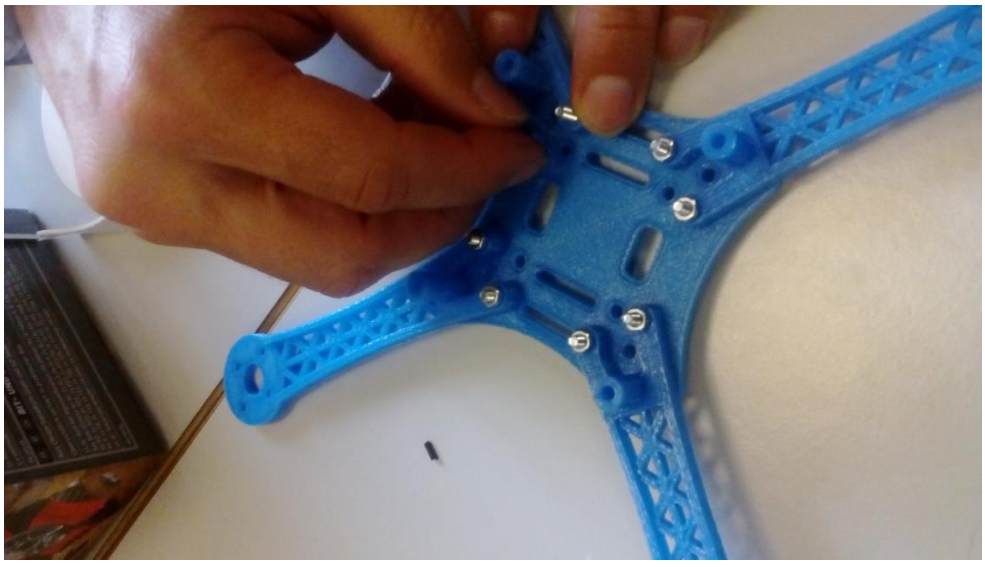
PLAN DE FORMACIÓN EN
LENGUAS EXTRANJERAS IN-57

Comunidad de Madrid
CONSEJERÍA DE EDUCACIÓN

STRUCTURES:

DESIGNING AND MAKING A DRONE FRAME



JESÚS CASAS SACRISTÁN

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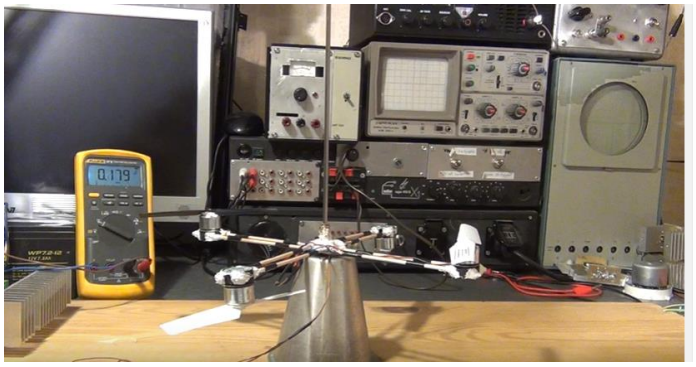
1- DIDACTIC PROJECT

1.1 INTRODUCTION

The goal of this project is to enable learners to design, plan and implement a technical project and make it with a 3D printer. For 2º grade (ESO).

Warming up

(VIDEO)



https://www.youtube.com/watch?v=qa_x93JQhNM

Preview Activity

Discuss with your partner the following terms:

- Multirotor drone
- Electronic control circuitry
- DC motors
- Plastic fibres / carbon fibres

Predictions:

Will drones construct structures in the future?

Will drones construct other drones?

(Discuss with your partner)

1.2 GOAL

The GOALs of this activity are to manufacture of a drone frame and research possible practical applications that your design, installation and application may have in the classroom.

In this activity students will design and make the frame of a drone (cuadricopter) with software and 3D printer supplied by the teacher.

The drones can give much didactic objectives in the classroom:

- In the analysis of the technologies involved: design, structure, mechanics, computer science, aerospace...

- In the process of assembly, disassembly and the drone con figuration.

- In the study of current applications of drones and the design of new ones.

- In the gamification of educational processes.

1.3 LESSON PLAN

LESSON PLANS – Grade 2º ESO

LESSON: Structures

Learning Areas: Technology		**Grade: 2**
Duration: 8 hours		**Weeks: 4**
Learning Outcome	**Assessment Standards**	**Integration**
Technological processes and skills	Investigates Designs Makes Evaluates Communicates	Languages Economic and Management Sciences Mathematics Arts and Culture Natural Sciences
Technological knowledge and understanding	Structures	
Technology, society and the environment	Modern Technology and Culture Impact of Technology Bias in Technology	

Content/Knowledge:
Structures:

- Learn how to make structures rigid and stable
- Find out how drones affect our lives
- Design and build a drone frame

Learning activities	**Teaching methods/approach**	**Resources**
Lesson 1: Parts of structures	Activity 1: Identify the technology problem Activity 2: Investigate parts of structures	Technology 2º Grade Book and Teacher's Guide A stiff foam cushion Thick card Paper fasteners Scissors A sharp-pointed object
Lesson 2: Beams in structures	Activity 3: Identify support of beams Activity 4,: Identify forces in beams	
Lesson 3: Frame structures or trusses	Activity 5: Investigate rigidity – make and reinforce a rectangular frame Activity 6: Look at cost-effective solutions Activity 7: Investigate **triangulation in trusses** Activity 8: Identify and tabulate types of forces in structures Activity 9: Investigate the stability of structures Activity 10: Look at **centre of gravity** and stability of towers and pylons	
Lesson 4: Capability task **(2 weeks)**	Design, make, investigate, evaluate, communicate: a drone frame	
Lesson 5: Assessment	Assessment activity	
Assessment: **Type of assessment:** Formal assessment for Lessons 1-4(**RUBRIC**) Informal assessment: all other activities can be used for informal	**Reinforcement:** Assist learners with reading difficulties **Expanded opportunities:** Identify structures and members in local area Sketch a beam in a bridge	

Teacher reflection:	

1.4 RUBRIC

Activity:			**Name:**		
Date:			**Grade:**		
	Level 5 Excellent achievement far exceeding expected requirements	**Level 4** A good achievement meeting most of the requirements	**Level 3** A fair achievement meeting an adequate portion of the requirements	**Level 2** An elementary achievement marginally satisfying the requirements	**Level 1** Unsatisfactory achievement. Requirements not met
Investigate					
Design					
Make					
Evaluate					
Communicate					
Technological knowledge & understanding					
Technology, society and environment					

1.5 DEBRIEF

The class must read the following text, and in groups debrief.

What are the rules for flying drones in the UK?

The answer, in short, is 'yes' - with some provisos. The CAA admits that the rules and regulations around drone use are "evolving", but this is the state of play at the moment: drones are classified as "unmanned aircraft", and the CAA is keen to point out that they are most certainly a type of aircraft and "not toys".

If your drone weighs over 20kg then you're out of luck - it's only legal to use it in certified "danger areas" such as Parc Aberporth aerodrome in West Wales.

Even those using a drone weighing less than 20kg for commercial use – receiving payment of any sort – are required to seek permission from the CAA. To get permission you will have to show that you are "sufficiently competent". This is less clear-cut than manned aircraft, which has a well-established licensing procedure.

If your drone is under 20kg and you're not using it for commercial reasons, then you still have some rules to follow. Anyone filming with a drone for their own purposes must avoid flying it within 150 metres of a congested area and 50 metres of a person, vessel, vehicle or structure not under the control of the pilot.You will also need to fly the aircraft within sight. This means you can't go above 400ft in altitude or further than 500 metres horizontally. If you want to exceed that, you'll again need to seek explicit permission from the CAA.

http://www.telegraph.co.uk/technology/2016/04/18/drone-laws-in-the-uk--what-are-the-rules/

2- TECHNICAL PROJECT

2.1 INTRODUCCIÓN

The goal of this part of the project is to give guidance to students so they can build the drone frame with success.

The teacher will give some instructions about computer software involved, the tools necessary and the entire tasks required.

Prior knowledge needed includes:

- handle with different operating systems
- designing with TINKERCAD software
- generation of STL files
- extrusion with Leon 3D printer

2.2 STEPS OF THE PROJECT

2.1 TOOLS

• Small pliers to hold nuts or elements of the structure
• Flat screwdriver to tighten screws of M3
• 3D printer and software design and 3D printing

2.2 materials

The drones are constructed by combining several basic systems.
According to the classical aeronautical terminology:

(1) cell, which is the body of the appliance chassis, base, the fuselage, wings,

arms, landing gear... All made of plastic

(2) Propulsion system: in this case it is internal, electric motors,
batteries, etc., which could be outside in the case of a hot air balloon.

(3) Command and control system: includes the controller card of flight sensors,

gyroscopes, accelerometers, radio station and the receiver, GPS...

(4) And the load is considered another system, which may be a camera, or a

package whose maximum weight depends on the
capacity of the drone to carry weight.

For didactic reasons, we can also classify the elements necessary for the construction of a drone in the different technologies that we study in class with the students: structure, mechanics, electricity, electronics, communications, and computer science.

ELEMENTS OF THE STRUCTURE

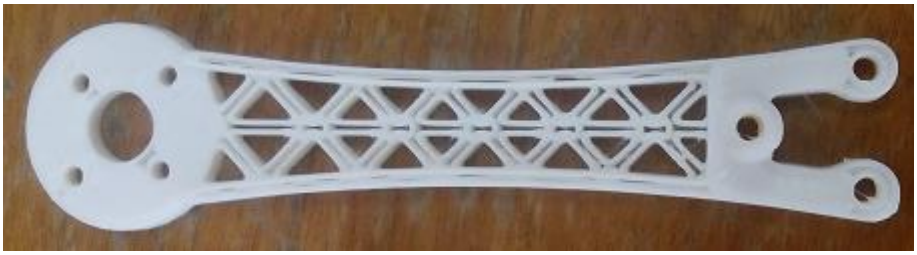
- Superior core
- Lower base
- 4 arms
- 12 M3 nuts
- 4 screws of M3 and 25 mm in length (ø 30 mm)
- 8 screws of M3 and 8 mm in length (ø 15 mm)

Images: I recommend marking the direction of the drone or N (north).

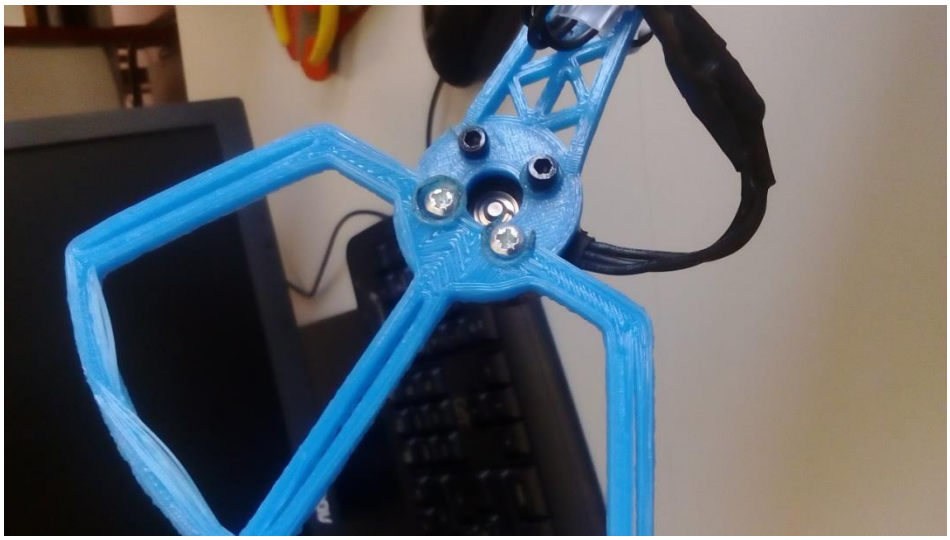
Optional:
• 4 blades fenders with screws
• 4-legged landing gear with retaining screws

Base or upper body

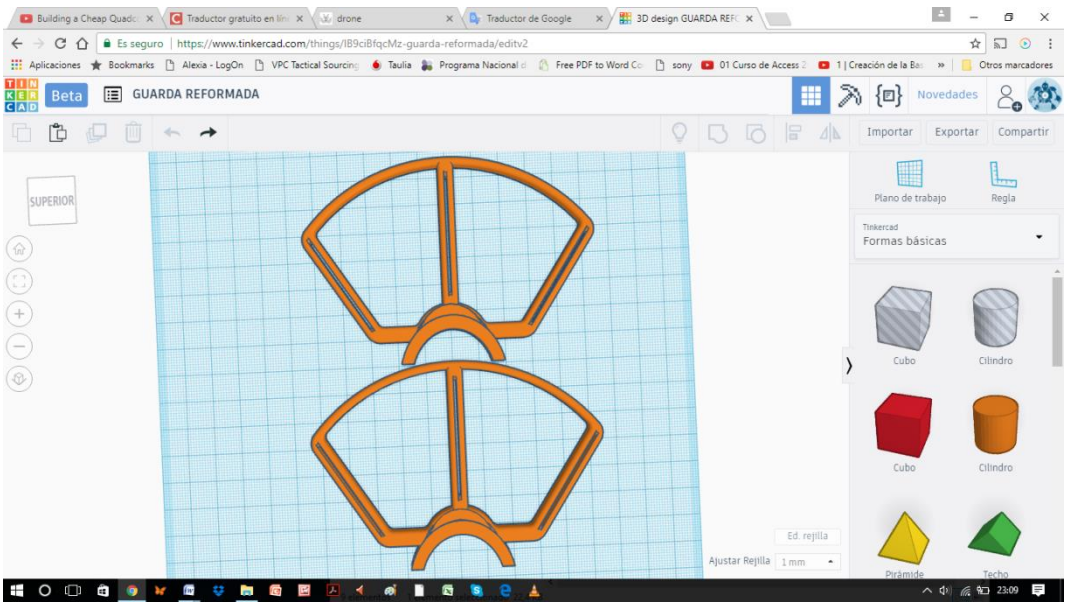
Arms



Blade fender

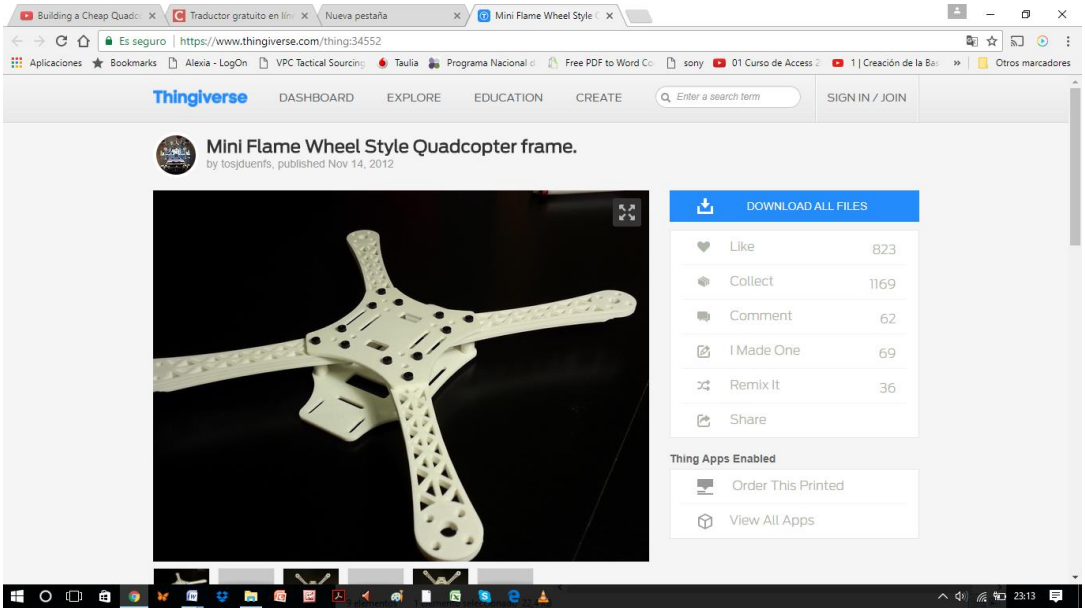


The basic structure of the drone can be bought online or downloaded in STL files to modify, redesign and print to a 3D printer.



You can download the bare frame of our drone On Thingiverse.

www.thingiverse.com/thing:34552

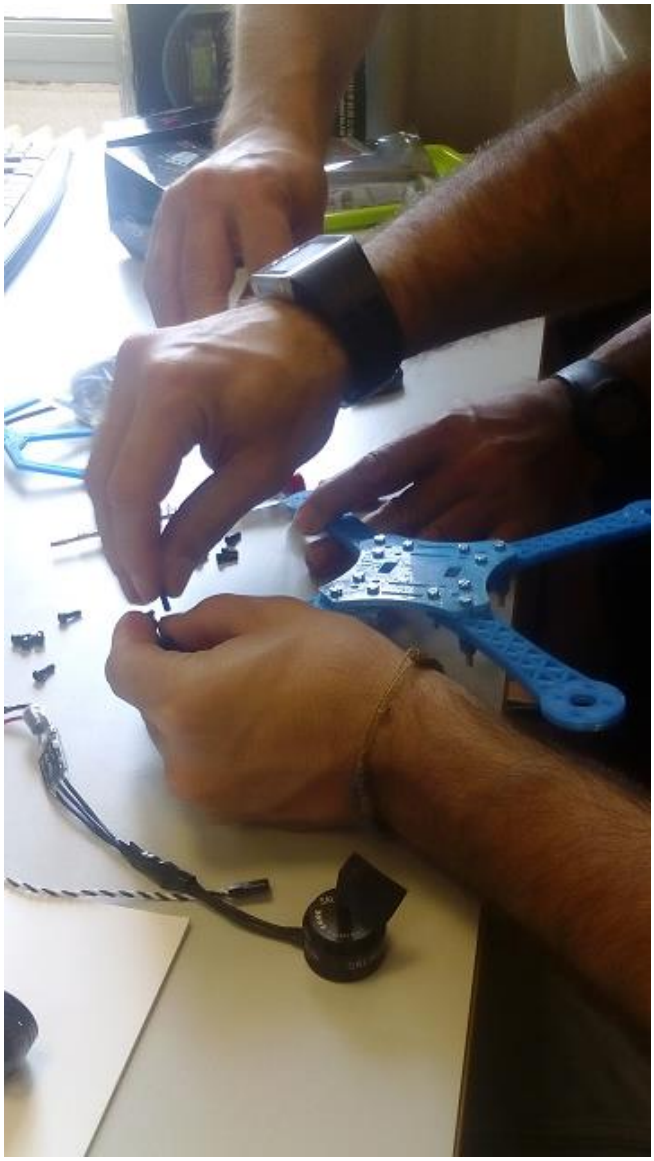


You can modify these files with 3D editing software to add some guards for blades and landing gear.

Although what is recommended on Thingiverse is printing on PLA 25% of infill, it is better to use other PLA materials that resist temperature such as ABS or PLA INGEO 3D 850.

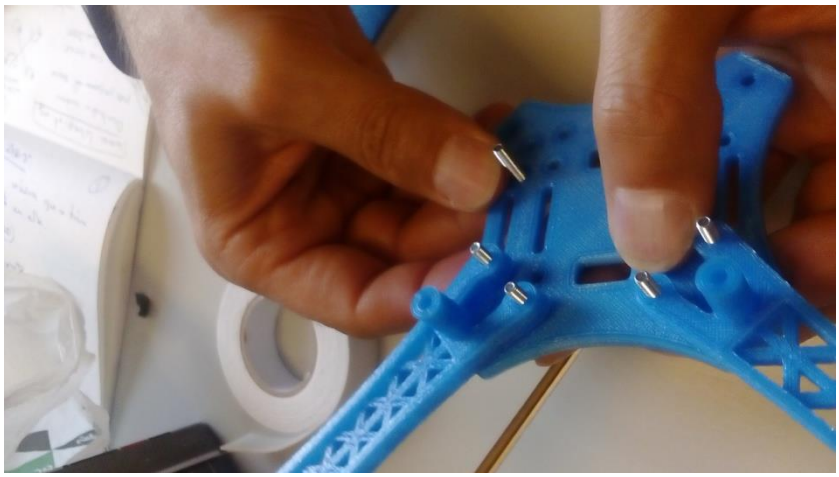
ASSEMBLY THE STRUCTURE

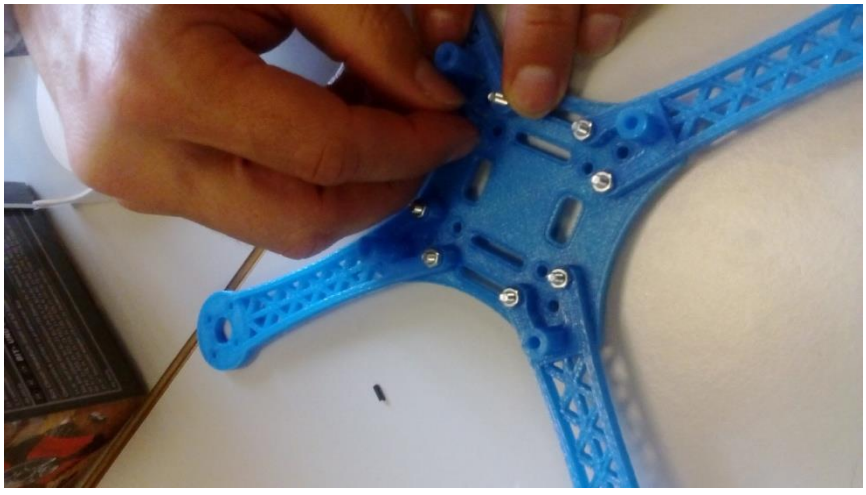
The structure must be as rigid as possible, so that it may not suffer vibrations or deformations that may confuse the sensors of the controller.



The structure consists of an upper base connected by four M· screws of 30 mm to a lower base. As you can see in the photos, we first join arms of the drone with the upper base. The union with the bottom is made later, so that we do not bother other systems (electrical or mechanical.)

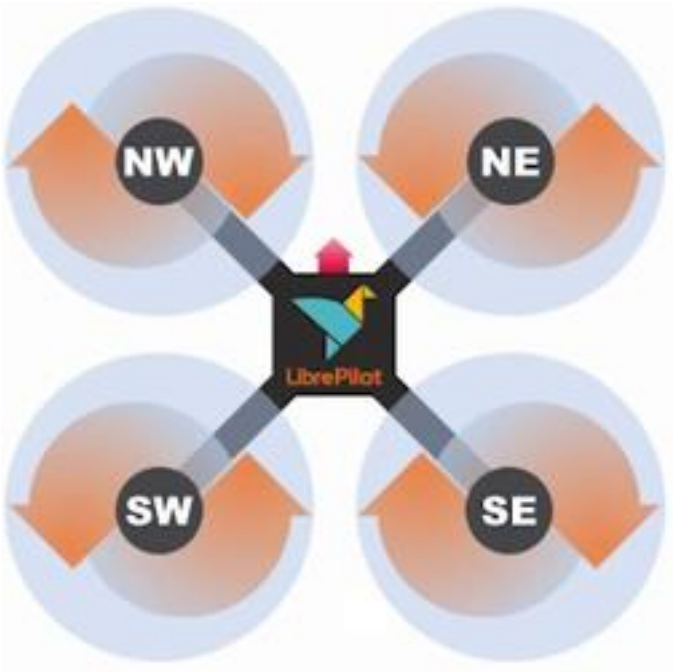
The upper base merges with the four arms with two screws per leg. The screws are M3 and 15 mm length.





Once the structure is made, it is important to make sure which direction is forward or north, and can be designated with a pencil on the upper base, looking to match the bottom according to the alignment of their slots or holes.

If it is not correctly marked, there may be a problem in the placement of the engines and their directions.



3- CONCLUSIONS

The drone is a robot. And it is an electric vehicle. It is a clear example for understanding updated and future technologies.

The use of drones in Technology subjects opens many possibilities for didactic development.

There are also several disadvantages to consider:

- The cost of the drones

- The difficulty of individual learning by working in large groups of pupils per drone, which would also affect the cost

-The strict implementation of security measures against the risks of drones, risk proportional to the power of the drone.

Because of these reasons it would be more convenient to study the use of other types of drones that are smaller, cheaper, easier to assemble and configure, more robust and resistant to blows and more stable and easy to fly.

At the bottom arises the concern of every teacher: **how fun can educational be**? It is the suspicion that behind fun there is usually no effort. Perhaps this is an opportunity to contradict this falsehood. Well, if the students try their best behind a ball, what will they do behind a drone?

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