

The Arduino Uno WiFi rev 2. (image: Arduino.cc)

# Use of Arduinos in Model Aircraft

Add a little computing power to your next project.



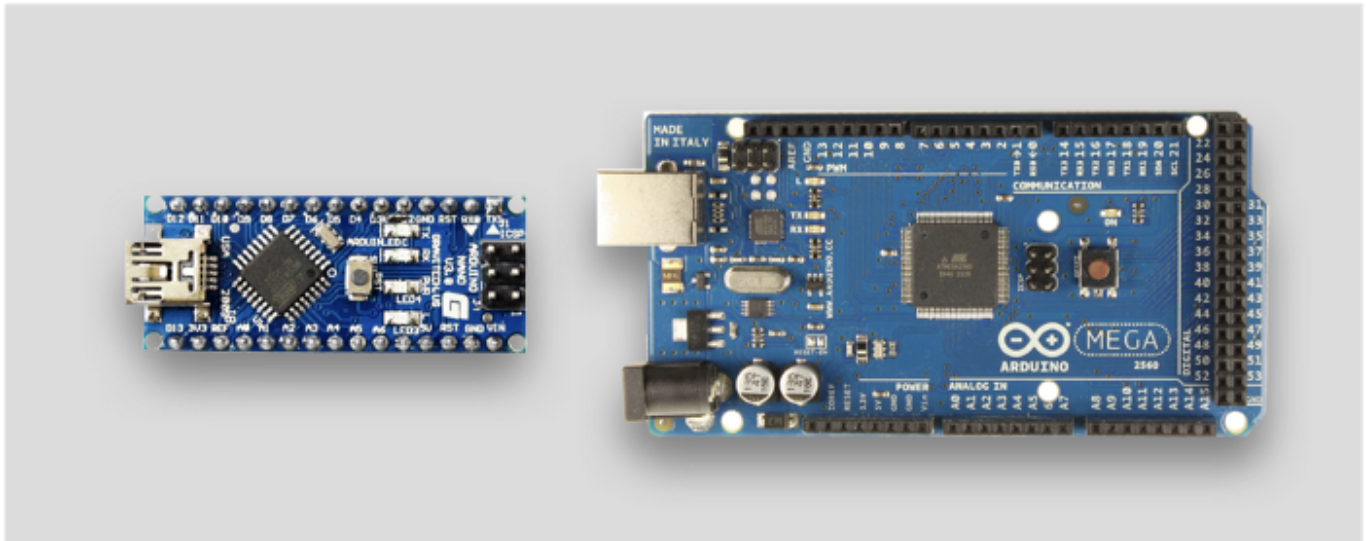
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What is an Arduino? It is a small, very cheap computer board intended for reading sensors and controlling things, for example using motors and servos. It was designed by Arduino.cc in Italy to get people to use computers in a more creative way, including what we now call Internet of Things (IoT). There are many different boards ranging in size from the Nano (18 x 45 mm and 7g) to the Mega (53 x102 mm and 37g). They differ mostly in the number of inputs and outputs. All are programmed using free software running on a personal computer, which can be running Linux, Windows or Mac, the simplest being on one running Linux, such as Ubuntu. There are smaller boards of

differing shapes but they are not ready to use. They are intended to be built into devices. You can power the board from the receiver supply using the red and black wires in a servo lead.

The whole project is Open Source, which means that the software is free and users share their programs and designs online. Don't worry if you have never written program code. There is a huge range of ready written code for just about any job you might want to do. You soon learn how to adapt the code if you really need to. It's all part of the fun.



The smallest Arduino (Nano) on the left and the largest (Mega) on the right. Images are not to scale relative to each other. (images: Arduino.cc)

## How Does It Work?

An Arduino has several inputs of two types. Inputs are pins onto which you can put voltages:

- Digital voltages, from a switch or other device, which have one of two values (0 and 1), for example 0V and 5V.
- Analogue voltages from sensors detecting such things as light, sound, temperature, pressure, potentiometer voltages etc. These can have any value between say 0V and 5V. The Arduino digitises them, which means it measures them and gives the value a binary number, for example between 0 for 0V and 1023 for 5V. In binary these are 0000000000 and 1111111111. Ten **B**inary **d**ig**IT**s (bits) are used so this is called 'ten-bit resolution'. Remember, there are 10 types of people. Those who understand binary and those who don't.

It also has several output pins from which signals may be sent:

- Digital outputs give 1 and 0 in the form of a voltage, for example 0 or 5V. These could be used for switching lights, relays and so on.
- Pulse width modulation outputs allow you to create varying signals. For example an on-off voltage could be used to drive a motor at different speeds, or a lamp at different brightnesses, by varying how long the signal is on rather than off (mark-space ratio). You could make sounds by sending varying signals to a loudspeaker. You can create the same servo signals that our receivers produce.

You either use standard code or write your own on your computer. You then send it to the Arduino through a lead. The chunks of code are called sketches. The software you need on your computer can be downloaded free of charge from the Arduino site.

## How Might We Use One in a Model Aircraft?

Several ideas spring immediately to mind:

- An Arduino can create the pulse width modulation signals that vary from 1 to 2 milliseconds in length, to operate our servos. They can drive low power servos directly but might need an additional board to boost the current for larger ones. If you have a scale model with complicated undercarriage doors and mechanisms, you could build a sequencer that drives the door servos and retracts at a chosen speed and in the order you want. The Arduino would read a start signal from a switched receiver channel and then go into its retract sequences.
- You could operate landing lights and steady or flashing navigation lights. You could even power up some high intensity LEDs if the model thermals too high to see clearly.
- Along the lines of a free flight dethermaliser you could automatically raise airbrakes at a pre-determined height, read from a GPS or variometer telemetry sensor.
- For rubber powered free flight models you could build an electric winder that would program and count the turns on a stepper motor. Yes, I have one of these in the design stage.

- Free flight F1A/A2 gliders are released at speed from a 50m towline and follow a vertical S-shaped path of half a loop and half a bunt. They can gain up to another 50m in this way. The Arduino could control the elevator servo to do this without breaking the competition rules.

## How to Get Started

You can buy a board, a power supply, a USB lead and a set of components for about £35 (\$45), for example on eBay. You never know, you might get hooked on these control systems and start building all kinds of clever things. It is probably best to start with the middle-sized Uno. Cheaper compatibles are usually fine and should have the same mounting holes as the original Arduino ones. You will also need connecting (jumper) leads that push on to the pins or into sockets, so you need both male and female. They are sometimes called DuPont wires. A breadboard is also useful for plugging up circuits as you experiment. Here are some typical prices as of 2020.

Uno (Compatible) Board	£5.00
5V power supply	£5.00
USB lead	£2.00
Sensor kit (37 devices)	£12.00
Stepper Motor	£4.00
Connecting Wires	£4.00
Breadboard	£3.00

The sensor kit will include a huge range of input devices, to sense such things as light, infrared, sound, temperature, wetness, proximity, tilt, joystick movement, vibration, time, rotation and magnetism and will have some output LEDs and sounders. You can use the small 9g servos that cost around £2 or low power stepper motors.

There are plenty of books to get you started. It will be obvious which are for beginners. You will be amazed how quickly you pick it up. It is best to start no later than early afternoon or you will look up from your bench and find it is 4 am.

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