



ΔΙΟΡΓΑΝΩΣΗ

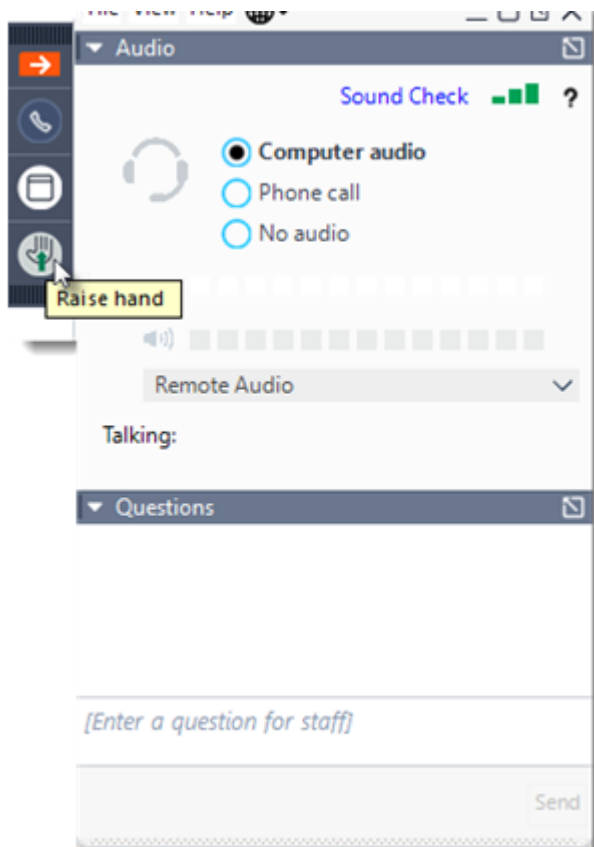
«Η χρήση απομακρυσμένων εργαστηρίων Arduino στην Δευτεροβάθμια εκπαίδευση» Πέμπτη 28 Απριλίου 2022 5-6:30μμ



Πρόγραμμα Ημερίδας

5:00-5:05	Έναρξη ημερίδας
5:05-5:15	Σύντομη παρουσίαση του έργου SYS STEM Νεφέλη Δημοπούλου, IDEC SA
5:15-5:35	Το STEM στην Εκπαίδευση Σαράντος Ψυχάρης, Καθηγητής ΑΣΠΑΙΤΕ, Πρόεδρος Ελληνικής Εκπαιδευτικής Ένωσης S.T.E.M.
5:35-5:55	Χρήση απομακρυσμένων εργαστηρίων Arduino Κωνσταντίνος Καραμπίδης, Ελληνικό Μεσογειακό Πανεπιστήμιο
5:55-6:15	Εξ αποστάσεως υλοποίηση εργαστηριακών δραστηριοτήτων με Ανοιχτή Σχεδίαση στην Εκπαίδευση των Μηχανικών Κωνσταντίνος Καλοβρέκτης, Πανεπιστήμιο Θεσσαλίας
6:15-6:20	Ευκαιρίες συμμετοχής σε Ευρωπαϊκά έργα Νεφέλη Δημοπούλου, IDEC SA
6:20-6:30	Συζήτηση - Ερωτήσεις Κλείσιμο ημερίδας

GoToWebinar





Arduino SYS-STEM for School

Παρουσίαση του έργου





SYS STEM

- Erasmus+ Στρατηγικές Συμπράξεις στην Σχολική Εκπαίδευση
- Έναρξη: 01-10-2019

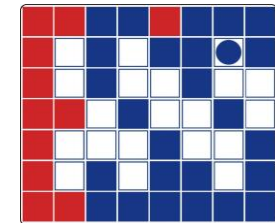


POLITEKNIKA IKASTEGIA
TXORIERRI
S.COOP.

Ισπανία



Πορτογαλία



Κροατία





Στόχος



- Το Arduino SYS-STEM for Schools **παρέχει εύκολη πρόσβαση σε ποιοτικό παιδαγωγικό υλικό και το απαραίτητο υλικό/λογισμικό arduino** ενός ArdLAB .
- Οι βασικοί στόχοι του έργου SYS-STEM είναι:
 - να αξιοποιήσει τις καινοτόμες δυνατότητες της τεχνολογίας arduino για να την καταστήσει προσιτή σε μεγάλο αριθμό μαθητών
 - να προωθήσει τη συνεργασία μεταξύ σχολείων, παρόχων επαγγελματικής εκπαίδευσης και κατάρτισης και ιδρυμάτων τριτοβάθμιας εκπαίδευσης
 - να παρέχει στους εκπαιδευτικούς Β'/θμιας εκπαίδευσης **ΑΝΟΙΧΤΗ ΠΡΟΣΒΑΣΗ** στην τεχνολογία arduino
 - να υποστηρίξει τα σχολεία και τους καθηγητές τεχνολογίας να δημιουργήσουν το δικό τους ArdLAB
 - να υποστηρίξει την εφαρμογή εργαλείων STEM στην εκπαίδευση





Αποτελέσματα

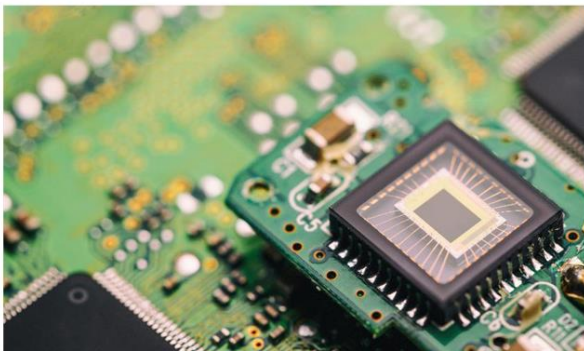
- 1) Μεθοδολογία SYS STEM
 - Ένα πακέτο εκπαιδευτικών υλικών χρήσης Arduino για μαθητές ηλικίας 14-18 ετών, όπου κάθε ενότητα περιλαμβάνει εκπαιδευτικά υλικά με παραδείγματα, προσομοιώσεις, δείγματα ασκήσεων στο Arduino και λύσεις.
 - Συνολικά έχει 10 ενότητες



1) Εισαγωγή στο STEM και την προσέγγιση SYS STEM




WHAT IS STEM?



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WHAT ARE ARDLABS AND DISTANT ARDLABS?

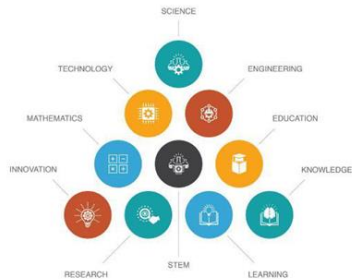
- Ardlab is an Arduino based laboratory that allows you to perform STEM experiments.
- A remote ArdLab has the same capabilities as in person labs but allows users to perform experiments from their homes or classrooms regardless of the distance.
- All you need to experiment in STEM is a computer and an internet connection.

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STEM

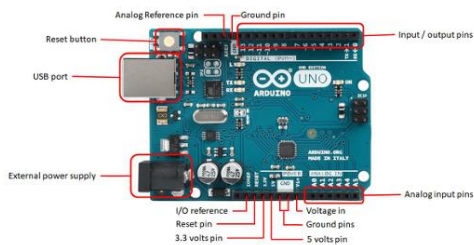
- It is a new way of teaching technology-related subjects.
- Practical and theoretical teaching.
- Hands-on minds-on lessons.



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2) Εισαγωγή στο Arduino



ARDUINO BOARD PARTS

The image shows an Arduino UNO board in which the main parts have been highlighted.

Most interesting parts are connection pins, that will allow the connection of components, sensors etc.

USB port to connect the cable to program Arduino.

Reset button to start over the program.

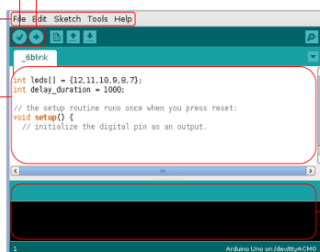
DEVICE PARTS DESCRIPTION

- ▶ Analog reference pin (AREF)
 - ▶ Rarely used pin, for advanced users. It sets an analog voltage reference
- ▶ Ground pin (GND)
 - ▶ Can be found either at the top part (one pin) and at the bottom part of the board (two ground pins). It sets the 0 voltage reference, needed to complete the circuits of a large amount of devices
- ▶ Input / output reference (IOREF)
 - ▶ This pin supplies a voltage corresponding to the I/O voltage of the board, in Arduino UNO case the value of this voltage will be 5 volts.
- ▶ Reset pin (RESET)
 - ▶ This pin will allow to recreate the original reset switch button on the board, in order to be able to reset Arduino if the original reset is not at hand.

ARDUINO IDE INTERFACE

Compile: this option will check the sketch and tell us if any error was found in it

Sketch: in this area the sketch that will later be transferred to the will be written, some of the reserved words will be highlighted in different colours

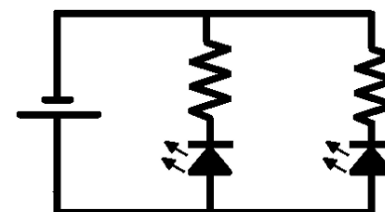


Program: this option will send the sketch to Arduino board providing there isn't any error in it. This sketch will remain in the Arduino board until another sketch is programmed over it

Error report: once the sketch is written, when the program or compile button are pushed, the error(s), if any, will be reported in this area. It will be useful to make the corrections

Menu: tolos for the Arduino IDE software handling are provided here

EXERCISE 2



In this circuit you will have two LEDs, and one resistor apiece, the objective is to make them work together at the same time

[Solution](#)

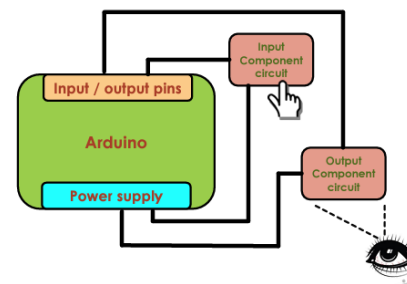
3) ΕΙΣΡΟΕΣ, ΕΚΡΟΕΣ ΚΑΙ ΔΙΑΚΟΠΕΣ



DIGITAL INPUTS AND OUTPUTS

Digital inputs and outputs in Arduino must be connected to the highlighted pins, numbered from 0 to 13.

The number of the pin is extremely important, as you will have to use it in the sketch to reference the devices you connect to Arduino.



PROPERTIES OF COMPONENTS

The aim of the digital inputs and outputs is to allow the connected devices to swap the voltage supply they receive between 0 volts and 5 volts.

The swap will allow the circuit to detect the devices as "ON" or "OFF".

The most basic inputs are switches but there is a wide range of sensors that behave as inputs as well.

Among the outputs the most basic are LEDs and buzzers but there are other ones such as LCD screen, servos...

INTEGRATING INPUTS AND OUTPUTS

Define the pin inputs and outputs must be integrated into your sketches, this means that you have somehow to tell Arduino **what kind of device** (input or output) you are going to use and **where** (the I/O pin) you will connect it.

There are, therefore, two tasks

1. Define the pin number where you will connect the I/O device with a code line:

```
const int <name_of_device> = <pin_number>;
```

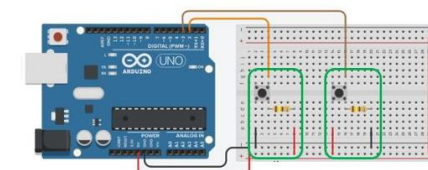
2. Let Arduino know the pin you are going to use and its function: input or output

```
pinMode(<name_of_device>, <kind_of_device>);
```

<kind_of_device> can be two different values: INPUT or OUTPUT, depending on the function of the component

SWITCHES AS INPUTS

Taking into account the previous circuit, you are able now to create a circuit carrying the buttons to a digital input pin, this way you are ready to add them to a sketch



4) Πρώτοι προγραμματισμοί



LED BLINK EVERY 0.5 SECONDS

- To do:
 - You will have to make a LED blink every 0.5 seconds lapses. Switch it on for 0.5 seconds and switch it off for another 0.5 seconds.
- Devices needed:
 - Arduino
 - Protoboard
 - LED(any color)
 - Wire
 - Programming USB cable

[Solution](#)

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LED AND BUTTON

- To do:
 - You will have to achieve, through a sketch, to give the button a switch behaviour, so that a short push of the button will swap the status of the LED permanently unless the button is pushed again
- Devices needed:
 - Arduino
 - Protoboard
 - Button
 - LED
 - Wire
 - Programming USB cable

[Solution](#)

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5) Μεταβλητές και σταθερές

Variable Types

- C/C++ defines several data types (more information <https://www.arduino.cc/reference/en/#data-types>)

Type	Description
bool	Can be true or false, but occupies 1 byte (boolean is an Arduino alias)
char	1 byte, from -128 to 127 (use only for storing characters)
byte	1 byte unsigned number, from 0 to 255
short	2 bytes, from -32,768 to 32,767
int	2 bytes or 4 bytes, depending on CPU architecture from -32,768 to 32,767 (16bit) or -2,147,483,648 to 2,147,483,647 (32bit)
unsigned int or word	from 0 to 65,535 (16bit) or 0 to 4,294,967,295 (32bit)
long	4 bytes from -2,147,483,648 to 2,147,483,647
float/double	4 bytes (8 bytes on Arduino DUE), from -3.4028235E+38 to 3.4028235E+38

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Expressions

- In the C++ programming language, a single equal sign = is called the assignment operator
- The arithmetic operators in C++ are:

Operator	Description
%	Remainder of the integer division
+	Addition
-	Subtraction
*	Multiplication
/	Division (integer division if both operands are integers)

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Arduino Memory

- There are three pools of memory in the microcontrollers used on Arduino boards (e.g. the Uno ATmega328P)

Flash memory (or program space) — where the Arduino sketch is stored

SRAM (Static Random Access Memory) — where the sketch creates and manipulates runtime variables

EEPROM — memory space that programmers can use to store long-term information

- Flash memory** and **EEPROM** memory are non-volatile (the information persists after the power is turned off)
- SRAM** is volatile and is lost when the power is cycled

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6) Λειτουργίες λήψης αποφάσεων και ελέγχου



if statement

```
if (Boolean_expression) {
    // statement(s) will execute if the boolean expression is true
}
```

- The **if** statement is used, to run some code only when the **Boolean_expression** is **true**
- If you only have one statement, you may exclude the **{ }**
- Example

```
If ( a > 20 ) {
    // if condition is true then turn on builtin LED
    digitalWrite(LED_BUILTIN, HIGH);
}
```

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for loop

- For loops are primary used, when the number of repetitions is known
- If you only have one statement, you may exclude the **{ }**
- Be careful not to add a **;** to the end of the **for ()** statement (otherwise the **for** has no statements)
- Example

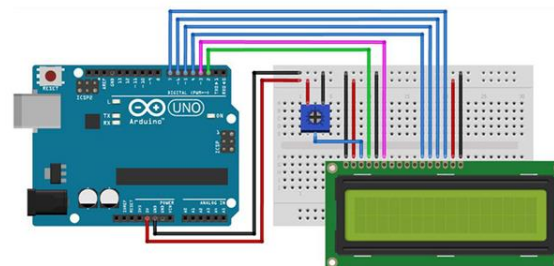
```
for(int i=1; i<10; i++){
    digitalWrite(LED_BUILTIN, HIGH); // Turns built-in LED on
    delay (150); // Pauses the program for 150ms
    digitalWrite(LED_BUILTIN, LOW); // Turns built-in LED off
    delay (1000); // Pauses the program for 1s (1000ms)
}
```

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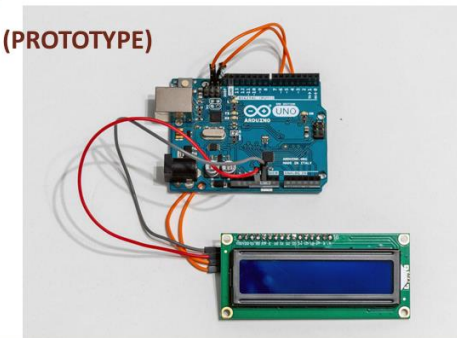


7) Οθόνες υγρών κρυστάλλων

PARALLEL COMMUNICATION (CIRCUIT)

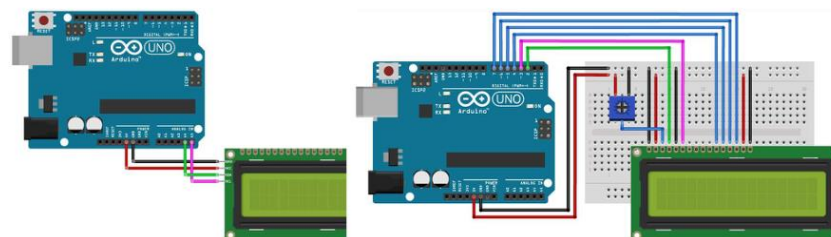


EXERCISE 1 (PROTOTYPE)



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PARALLEL VS SERIAL



A serial prototype using I2C. The circuit is much simpler than the parallel one.

A 4-bit parallel prototype. The missing 4 bits eliminate the need for 4 more wires, but make communication slower

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ABOUT LCD DISPLAYS

- An LCD display is an output peripheral that can be used to display most kind of data, including alphanumerical characters, symbols and even simple graphics
- They're distinguished in two major types; the more complex to use "matrix" displays and the simpler devices organized in rows and columns. On the right, you can see a sample of the later, that is, a 16 columns x 2 rows LCD display



The most common LCD display on the market; a 16x2 (cols x rows), based on the HD44780 controller by Hitachi

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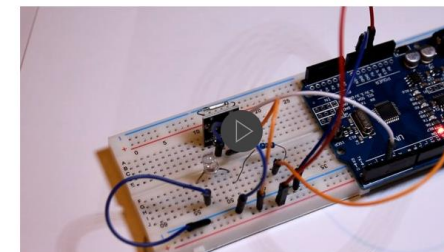
8) Αισθητήρες Arduino

ABOUT THE SENSOR

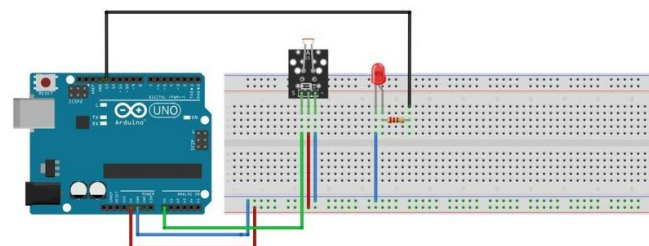
- ▶ The Tracking line module (KY-033) can detect the difference between dark and light background.
- ▶ It works on the principle of reflection of a light beam, which is reflected from a light (white) background, while light is absorbed on a dark (black) background and no reflection is created, ie. the light is not reflected.
- ▶ In this way it is possible to perform detection of dark and light background which allows application in tracking dark lines.



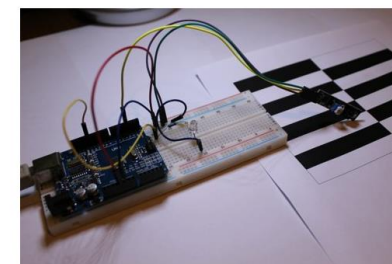
EXAMPLE – DEMONSTRATION OF WORK



EXAMPLE – WIRING DIAGRAM ON A BREADBOARD



EXAMPLE – DISPLAY OF THE CONNECTION ON THE BREADBOARD



9) Κινητήρες Servo & DC

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DC Motor

- Motion is continuous
- Speed controlled by applied voltage

Servo

- Capable of holding a position
- Speed controlled by delay between position updates
- Hybrid of motor, gears and controller.

Two types of servos

continuous rotation



- can rotate all the way around in specific direction
- pulse tells servo which way to spin & how fast to spin

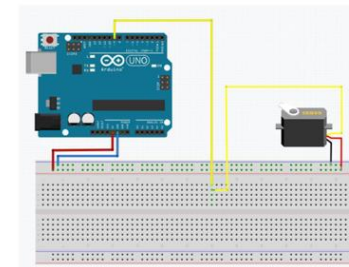
standard



- can only rotate 180 degrees
- pulse tells servo which position to hold

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Example - Wiring diagram on a breadboard (SERVO and CONTINUOUS SERVO)



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EXAMPLE - DISPLAY OF THE CONNECTION (CONTINUOUS SERVO)



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SERVO and CONTINUOUS SERVO

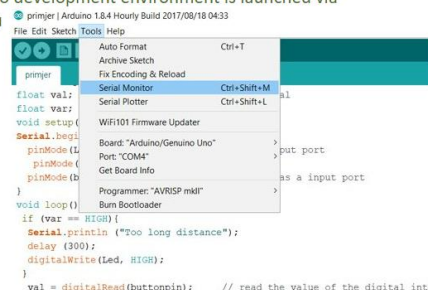


10) Παραδείγματα από τον πραγματικό κόσμο

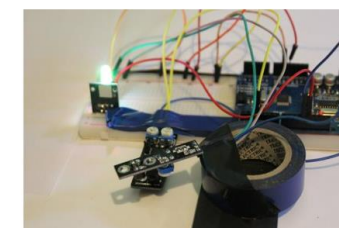
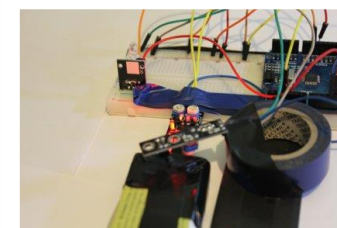


EXAMPLE - MEASURING AN ANALOG SENSOR SIGNAL

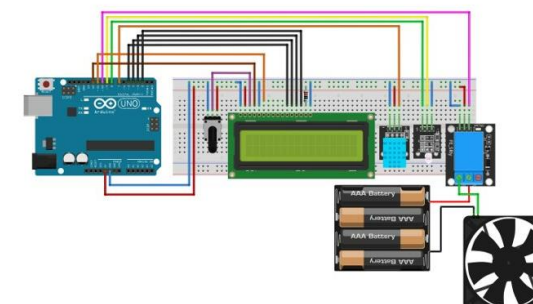
- The Serial Monitor of the Arduino development environment is launched via the Tools -> Serial Monitor menu



EXAMPLE – DISPLAY OF THE CONNECTION ON THE BREADBOARD



EXAMPLE – WIRING DIAGRAM ON A BREADBOARD



EXAMPLE – DEMONSTRATION OF WORK



Παραδοτέο 2) Κόμβος SYS-STEM ArdLAB

- Δημιουργία 5 απομακρυσμένων ArdLab
- Ενιαίος Κόμβος SYS-STEM ArdLAB: μια διαδικτυακή εφαρμογή που συγκεντρώνει και οργανώνει τις κρατήσεις χρονοθυρίδων για τα ArdLAB (εργαστήρια Arduino)
- Ο κόμβος SYS-STEM ArdLAB απαιτεί μόνο μια εγγραφή για την πρόσβαση στις λειτουργίες του. Οι χρήστες μπορούν να επιλέξουν την επιθυμητή ημέρα και ώρα για τη χρήση ενός απομακρυσμένου ArdLAB.

Πιλοτική Εφαρμογή

- Πιλοτική Εφαρμογή διάρκειας 3 εβδομάδων (έως 22/05/2022):
 - Της Μεθοδολογίας (2 Module το κάθε σχολείο με τουλάχιστον 10 μαθητές)
 - Χρήση των απομακρυσμένων εργαστηρίων ArdLab
- Για τα σχολεία που θα συμμετέχουν στην πιλοτική εφαρμογή, θα γίνει κλήρωση για 5 δωρεάν Arduino Starter Pack!
- Άρης Χρονόπουλος: aris@idec.gr
- Νεφέλη Δημοπούλου: nefeli@idec.gr



Ευχαριστούμε για την προσοχή
σας!

