

Embedded Systems

Start with the project early. The hardware needed for this project is available in our lab, building E1 3, room 301. We expect you to be careful with the provided material and to keep the room tidy. Especially, you should not leave configured breadboards. Make an appointment with Felix Klein to demonstrate your solution.

Problem 1: Install Arduino Software

Install the latest version of the Arduino software (currently 1.0.5) from the Arduino website arduino.cc. It is available for OS X, Linux, and Windows. As we are using the Arduino Nano, you may also need to install the latest version of the drivers from the FTDI website: www.ftdichip.com/Drivers/VCP.htm.

OS X 10.9 Mavericks users: If you encounter the error `avrdude: stk500_recv(): programmer is not responding`, have a look at forum.arduino.cc/index.php?topic=198539.0

Problem 2: Install Simulink Support Package

Open MATLAB and run Simulink. From the Simulink menubar select **Tools** → **Run on Target Hardware** → **Install/Update Support Package**. Select **Install from Internet** and choose the **Arduino Uno/Nano/Mega2560** package. After installation, follow the tutorial closely and make sure your target hardware options are set correctly (we use the Arduino Nano 3.0).

Problem 3: LED Game

Consider the following game: There are 3 LEDs which light up in a random combination. The probability distribution over the combinations is uniform and each combination is shown for 0.4 seconds. The player controls the game via an IR signal. Whenever the IR signal is sent at the right time (when all 3 LEDs are on), the player levels up. The player loses if the IR signal is sent at any other time. With each level, the light up time decreases by 0.02 seconds.

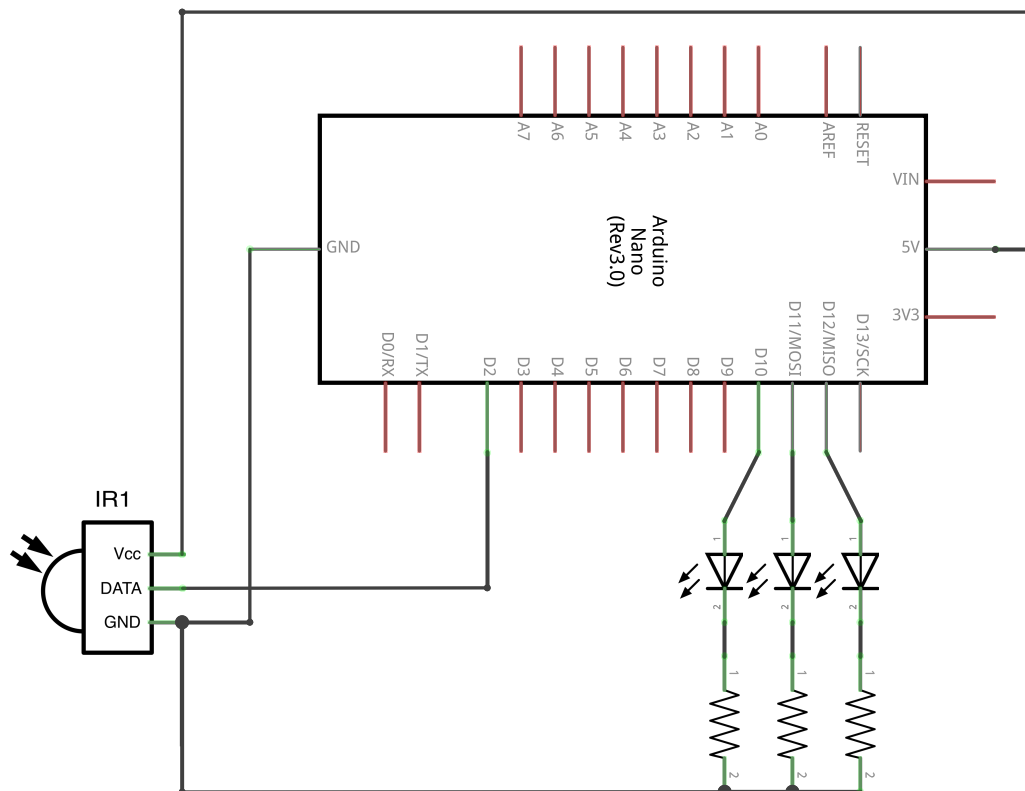


Figure 1: Example circuit for the LED game.

1. Create a circuit on a breadboard such that each LED can be controlled separately and the output of the IR receiver can be read. Be careful not to introduce a short circuit, which could damage the hardware (especially the LEDs). *Always place a resistor in the circuit that connects the LEDs.*

An example circuit is depicted in Figure 1.

2. Implement the LED game using the Arduino language.
3. Implement the LED game using the Arduino Target for Simulink.

We recommend reading the tutorials on the website arduino.cc. The data sheet of the IR receiver (TSOP4833) is available at www.vishay.com/docs/82459/tsop48.pdf.