A simple Arduino Based Oscilloscope for Physlab

Muhammad Shiraz Ahmad and Muhammad Sabieh Anwar
Department of Physics, Syed Babar Ali School of Science and Engineering

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Oscilloscope is one of the most important tools we find in physics or electronics laboratories. It is primarily used for viewing waveform and determining voltage levels, frequency, noise and other parameters of signals applied at its input that might change over time. The only issue is they can be very expensive. In this report, we show how to use Arduino and an open source software to build a low cost, 4-channel Arduino oscilloscope, with sampling frequency 500 Hz, capable of performing the tasks for which some of the cheap oscilloscopes are deployed like the display of waveforms and determination of voltage levels for signals.

Source site: http://bit.ly/PhysLab_SourceLink-GitHub

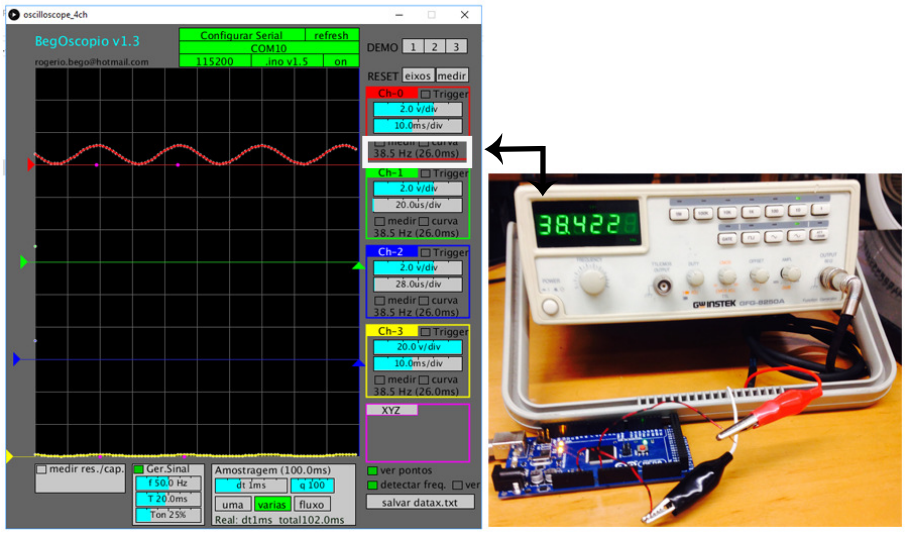

Figure 1: a) Arduino Based Oscilloscope reading signal from frequency generator on port A0. b) visual representation of same signal PC software

1 Getting Arduino Ready for Oscilloscope

1. Install Arduino IDE [1].
2. Install Java SE Runtime Environment [2].
3. Connect your Arduino board with an USB cable.
4. Run Arduino IDE and select the entry in the **Tools** → **Board** menu that corresponds to your Arduino board.

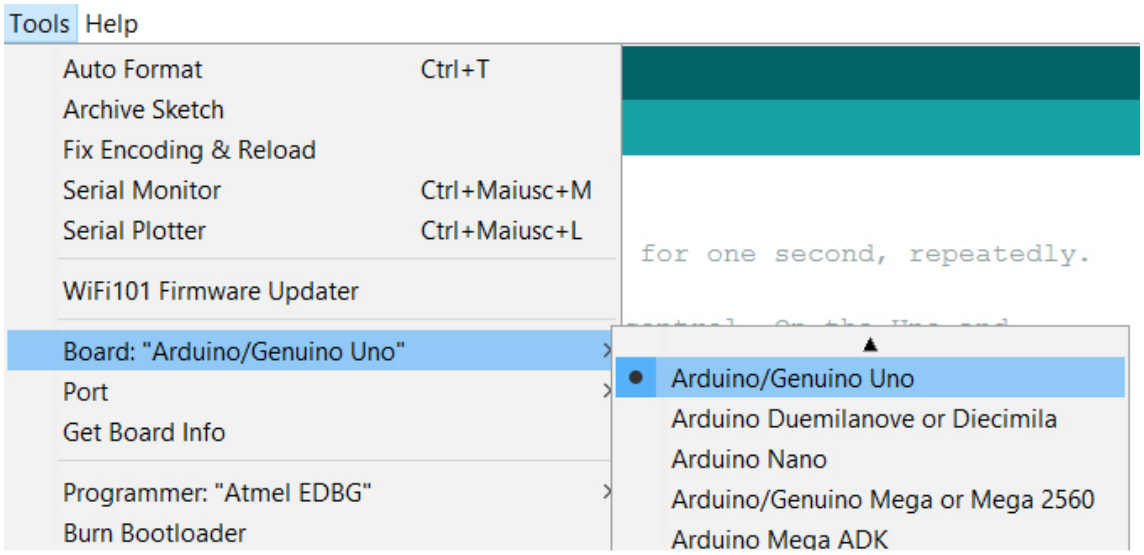

Figure 2

5. Select the serial device of the board from the **Tools** → **Serial Port** menu.

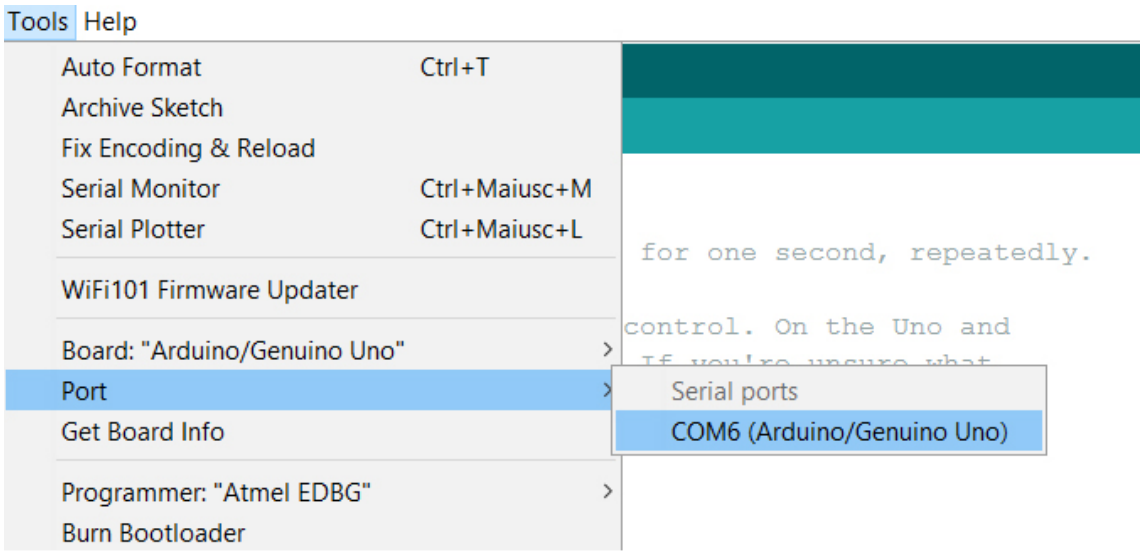

Figure 3

6. Install the "TimerOne.h" library for the Arduino IDE (for details, see appendix).
7. Download and run the Arduino program "oscilloscope_arduino.ino" from [3].
8. Adjust the COM port correctly (**Figure 3**).
9. Upload the program to Arduino (**Figure 4**).

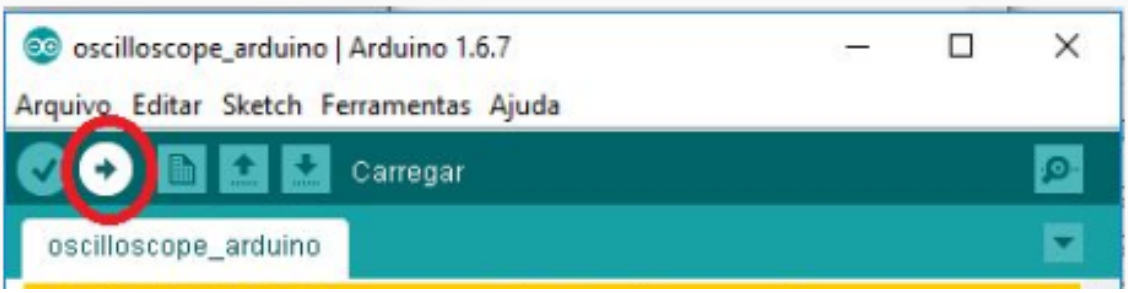

Figure 4

2 Using Arduino as an Oscilloscope

1. Download the Oscilloscope Processing Program (Use [4] for 32–bit or [5] for 64–bit windows).
2. Execute the Processing file **oscilloscope_4ch.exe**.
3. Click "select speed" until the speed 115200 appears (**Figure 5**).
4. Click "off" to switch to "on".
5. If everything is correct, the oscilloscope will show the 4 channels [A0 (ch–0), A1 (ch–1), A2 (ch–2) and A3 (ch–3)].

3 Oscilloscope Capabilities

1. It can monitor up to 4 voltage channels (0 to 5V).
2. It can measure frequency upto 500 Hz (tested on Arduino Mega).
3. It can stabilize the wave on the screen using a simple trigger.
4. It identifies the frequency of the wave using the best criterion (square or sinusoidal).
5. Volts/division and time/division can be adjusted individually for each channel.
6. It has a combined display of channels in XYZ.
7. It can be used as PWM signal generator.

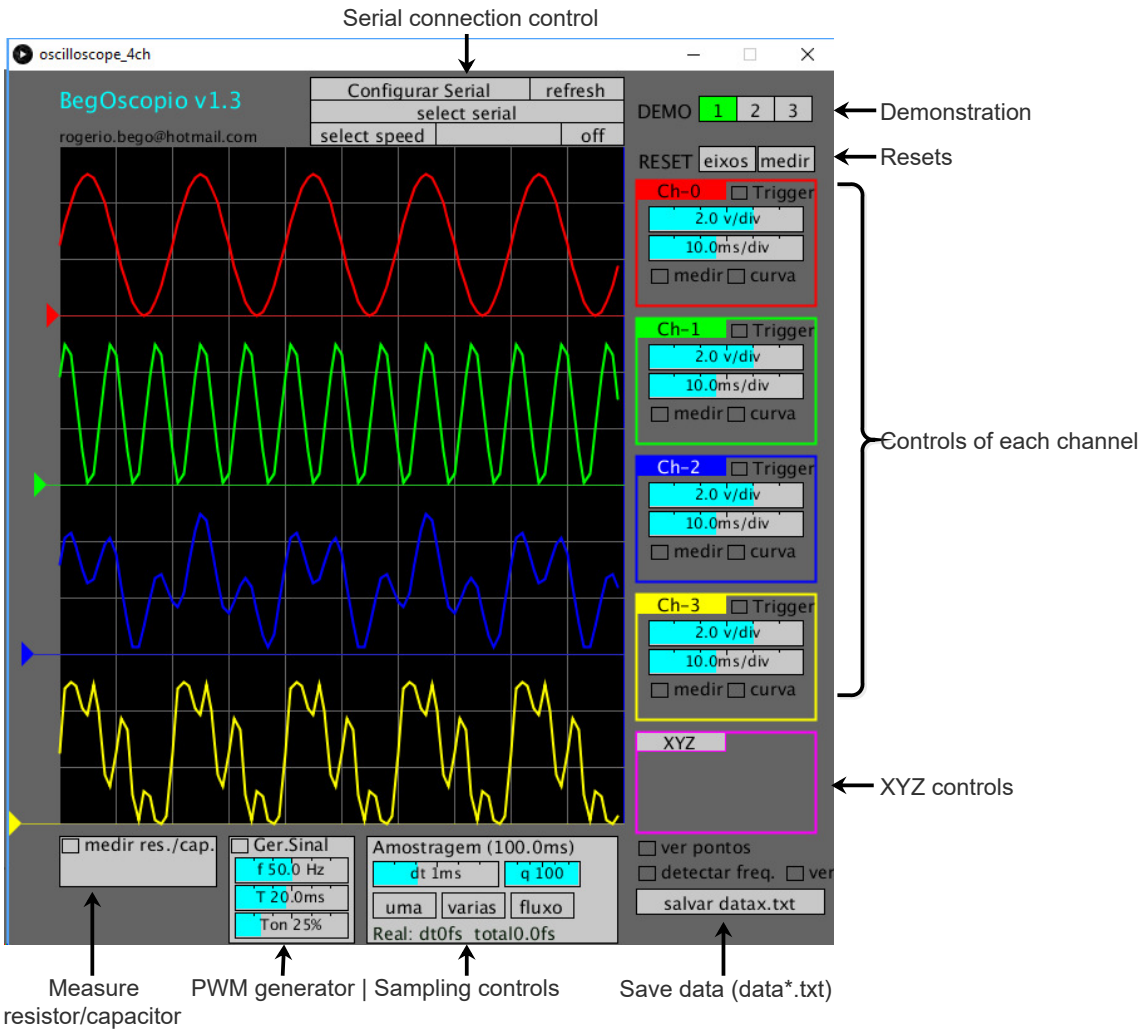

Figure 5

APPENDIX

Installiation of TimerOne.h Library

1. Run Arduino IDE and select the entry in the **Sketch** → **Include Library** → **Manage Libraries** to run `Library Manager`.
2. In `Library Manager`, type "TimerOne" in search field.
3. Information about the library will appear, click over that text and the "Install" button will appear.
4. click "Install".
5. Restart Arduino IDE.

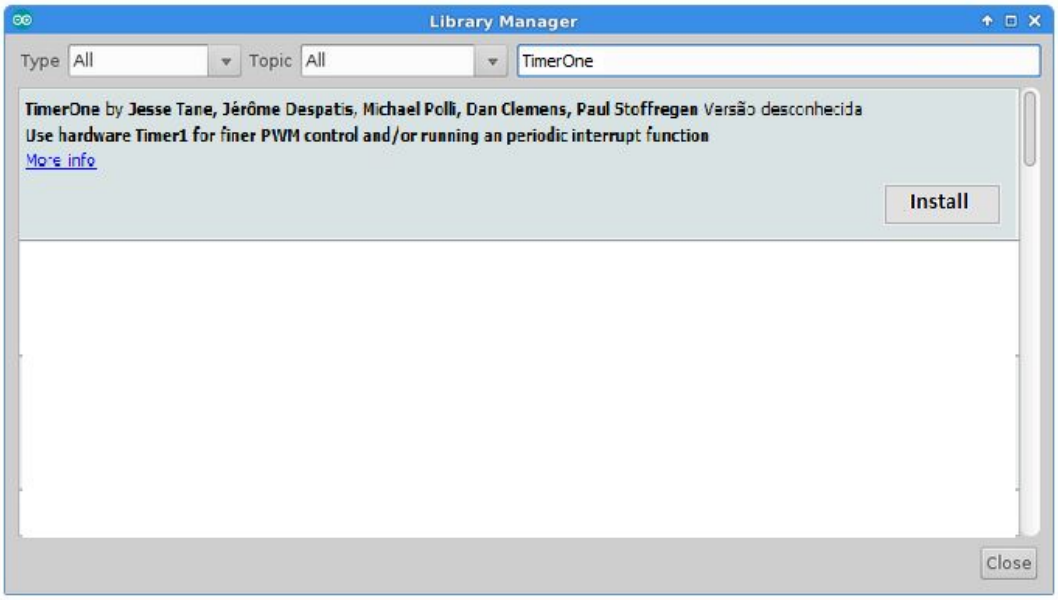

Fig.7

References

[1] http://bit.ly/PhysLab_Link01

[2] http://bit.ly/PhysLab_Link02

[3] http://bit.ly/PhysLab_Link03

[4] http://bit.ly/PhysLab_Link04

[5] http://bit.ly/PhysLab_Link05