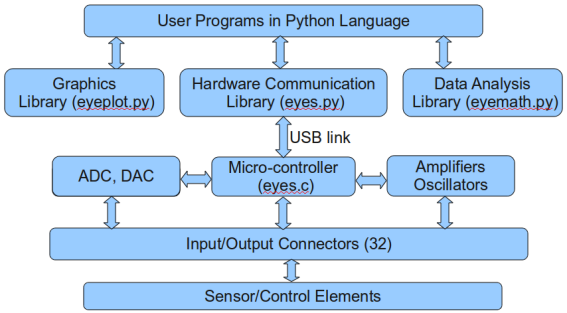
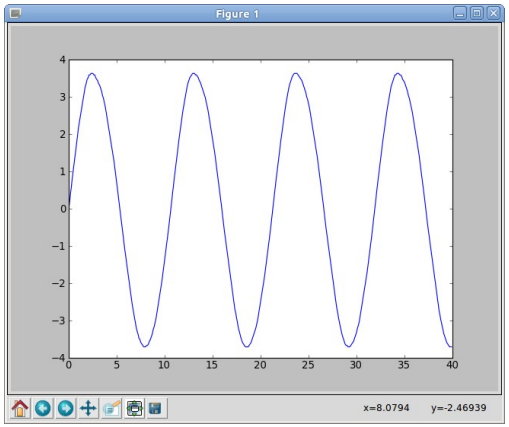


Hardware Features

- 12 bit Analog Input/Output
- Digital Input/Output
- Frequency Counters
- Waveform Generators
- Prog. Current Source
- Amplifiers

ExpEYES design is schematically shown above. Every hardware feature can be accessed by one line of Python code. For graphics, we have used Tkinter and Matplotlib. Data analysis is done using Numpy and Scipy modules. The example given below demonstrates the simplicity of the scheme. The code captures a sine wave, plots it and calculates the frequency by fitting.



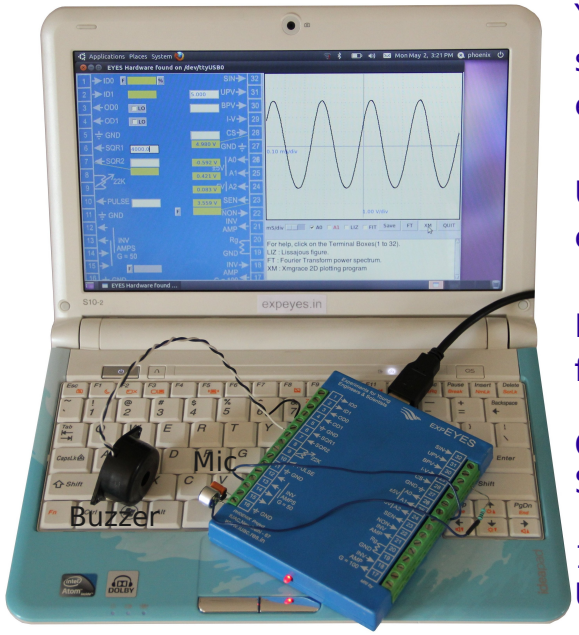

```
from pylab import *
import expeyes.eyes
import expeyes.eyemath

p = expeyes.eyes.open()
t,v= p.capture(0,400,100)
plot(t,v)
show()

vfit, par = em.fit_sine(t,v)
print par[1]
```

ExpEYES is a product from the PHOENIX project (Physics with Home-made Equipment & Innovative Experiments), started in 2004 by IUAC, with the objective of developing low cost laboratory equipment, using computers, and training teachers. Design of hardware developed is open and the software is distributed under GNU General Public License. Visit http://expeyes.in for details.

Inter University Accelerator Centre
(An Automomous Research Facility of UGC)
Aruna Asaf Ali Marg, New Delhi 110 067
www.iuac.res.in

expEYES

Experiments for Young Engineers & Scientists



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User manual with fifty experiments documented.

Built-in waveform generator, frequency counter and CRO.

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11 x 9 x 1.5cm, 150gm
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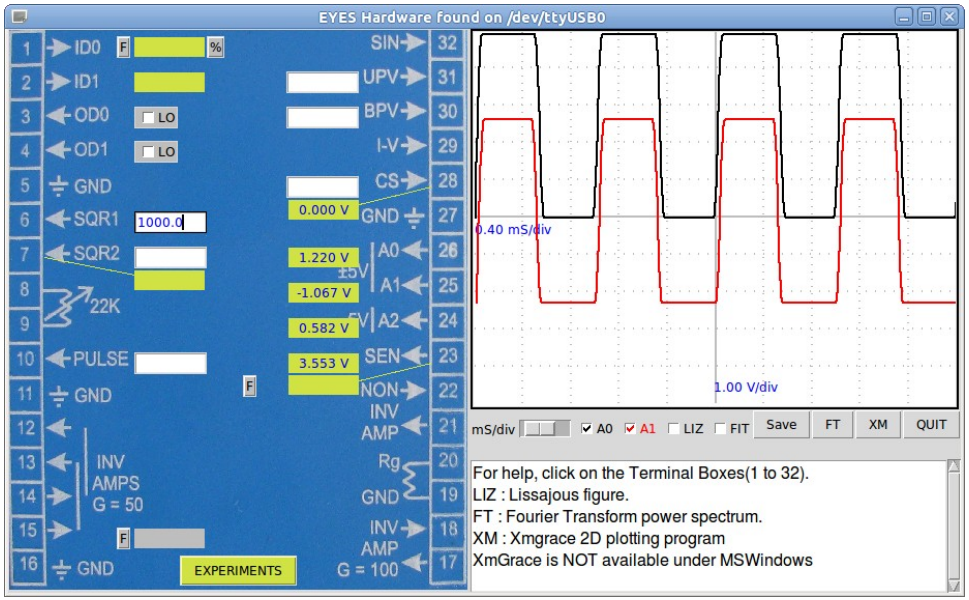
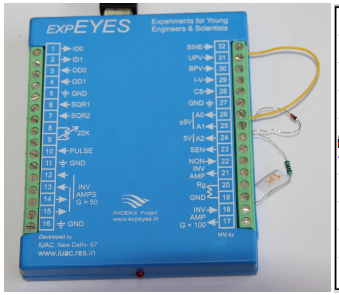
Digitizing sound using microphone

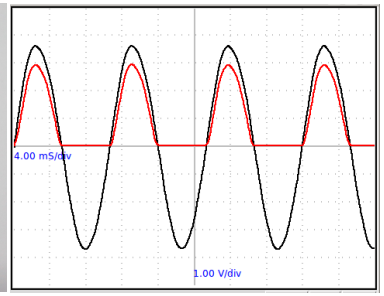
ExpEYES supports a wide range of experiments suitable for higher secondary, B.Sc and the first year electrical and electronics engineering degree courses. Visit http://expeyes.in for details.



expEYES GUI demonstrating DC blocking using a capacitor.

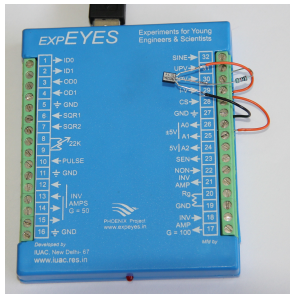
Half wave Rectifier

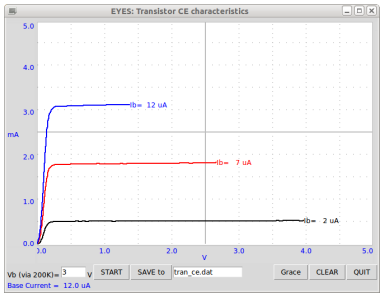




The black trace shows the direct sine wave. The red trace shows the output after passing through a PN junction diode. A load resistor of 1kOhm is connected from output to ground.

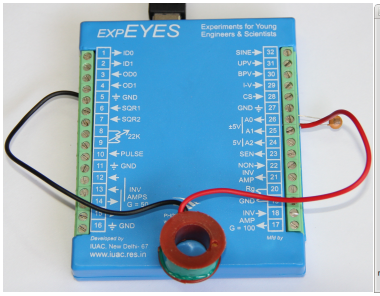
Transistor characteristic curve

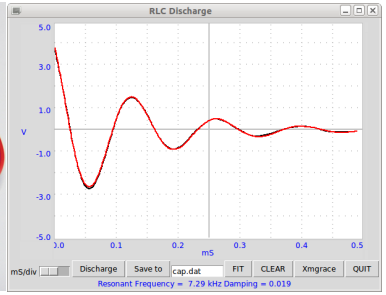




Collector and Base goes to two programmable voltage sources through 1k and 200k resistors respectively. Collector voltage is varied and plotted against collector current. This can be repeated for various base currents.

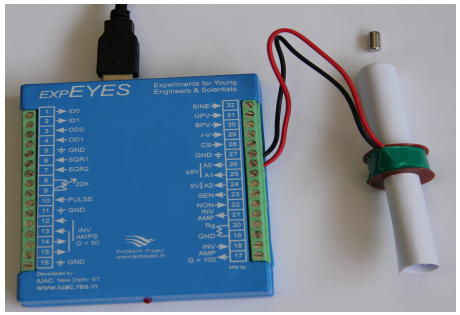
Transient response of LCR circuit

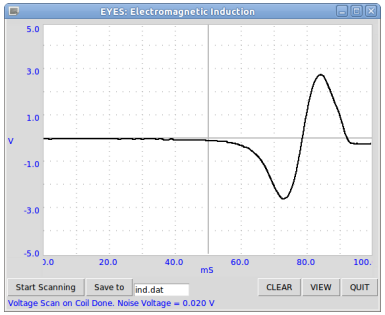




A step voltage is applied to an LC circuit. The voltage across the capacitor just after the step is shown above. Figure shows the under- damped case.

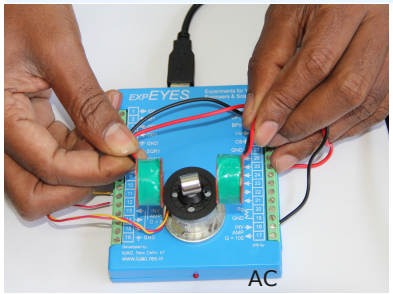
Voltage induced across a coil by a moving magnet

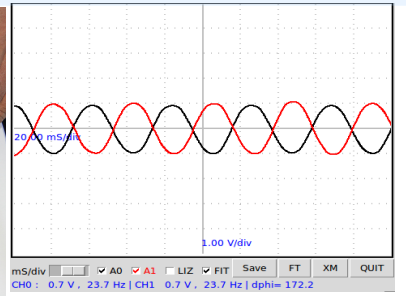




A cylindrically shaped permanent magnet is dropped in to a solenoid coil. The voltage induced across coil due to the changing magnetic field is shown above..

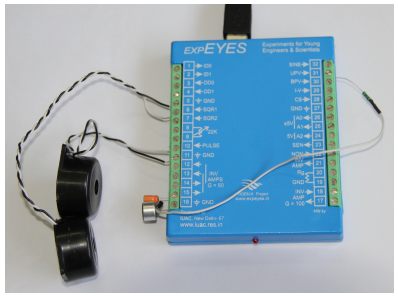
Two phase AC Generator using a rotating magnet and two coils

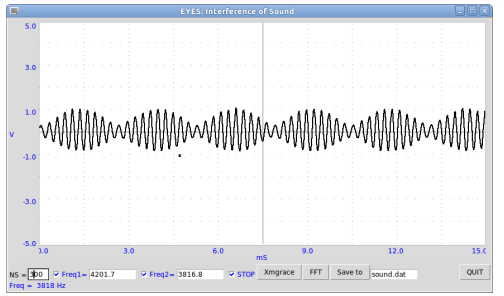




A rotating magnetic field is generated using a permanent magnet and a DC motor. The phase difference between the two voltages depends on the angle between the coils.

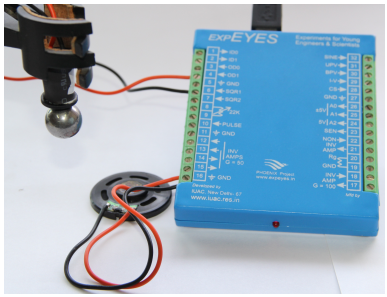
Interference of sound from two piezo-electric buzzers





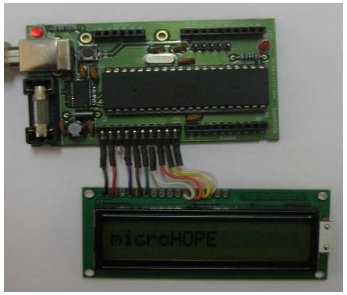
Two Piezo electric discs are made to generate sound having nearby frequencies. The resultant sound is captured by a microphone to show the beats.

Gravity by Time of Flight



A mild steel ball is held by an electromagnet at a known height. It is released under software control and the software also senses when it hits the bottom surface. This is done by sensing the vibrations, using a loudspeaker. Acceleration due to gravity is calculated from the time of flight and the height. Time of flight is measured within an accuracy of one millisecond.

MicroHOPE : A USB programmable micro-controller development system



Micro-controllers for Hobby Projects and Education has the following features:

- Powered and programmed using USB port
- IDE Software with GUI support
- Program in C
- Upload the code with a single click
- Uses Atmega32 MCU (32k Flash, 2k RAM)
- C Library for ADC, timer/counter, RS232 etc.
- LCD display support