

Technologies in STEM education

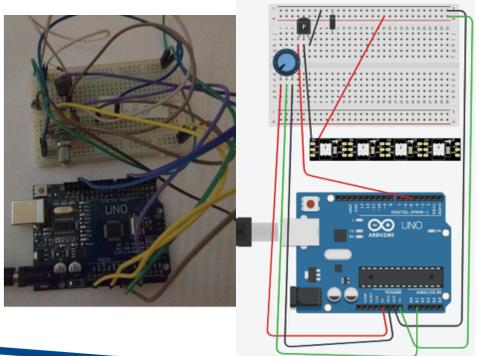
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“Defying” Gravity!

Many of human inventions are intertwined with man's need to “see” beyond his senses. His need to see beyond the limits of his vision led to the invention of the microscope and the telescope. When he constructed machines that moved much faster than the human eye could follow, he invented the **stroboscope**. Although most students are familiar with the microscope and the telescope, few have heard of the **stroboscopic effect**. In the present work, the basic principle of stroboscopy is applied in a different context. We study the **motion of the droplets** of a liquid and this leads to the creation of very impressive visual illusions. Through an **STEM** approach students combine basic principles of Physics (optics - sound - kinematics), with knowledge of **Technology** (Arduino), **Mathematics** (equations and statistics) and **Engineering** and they finally succeed to “trick” their senses and “see” beyond them.

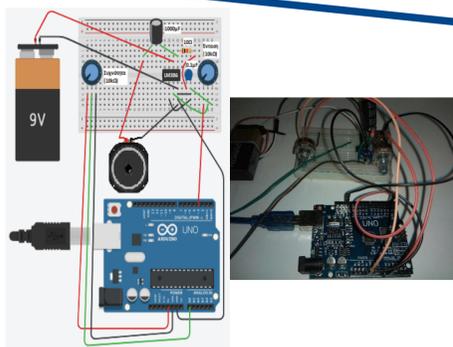
Stroboscopic System

This system is responsible for the production of short, repetitive flashes of light. The flash frequency is determined by an Arduino UNO microcontroller and it is regulated by a potentiometer.



Sound System

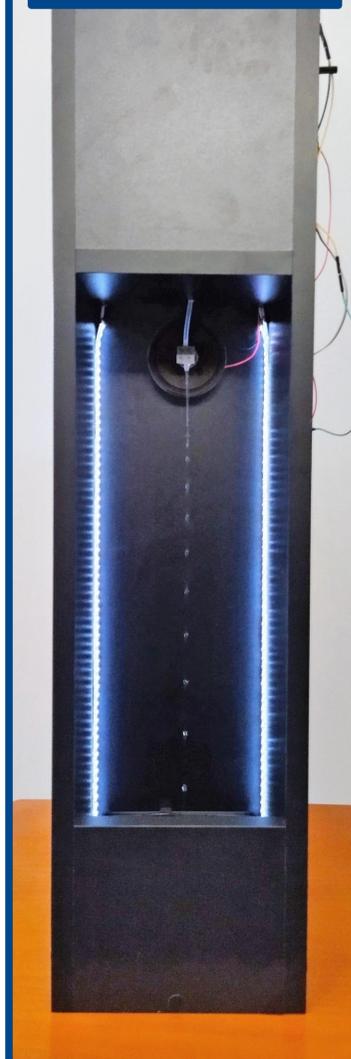
This system is responsible for the controlled vibration of the water droplets. The device uses a speaker, an electrical circuit acting as an amplifier, an Arduino UNO microcontroller and a potentiometer so as to adjust the audio output frequency.



Hydraulic System

This system is responsible for the flow of the water in the chamber and it is composed of two containers with a capacity of 1 liter each, a plastic pipe and the water flow controller.

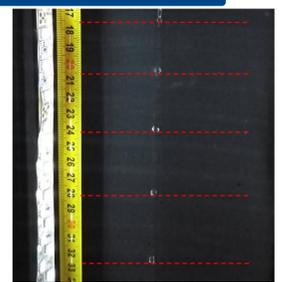
The Set-up



The Experiment

$$g = \frac{\Delta y' - \Delta y}{T^2}$$

$$T = 0.02s$$



y (cm)	Δy (cm)	g (m/s ²)
18.0	---	---
21.2	3.2	---
24.8	3.6	10.0
28.9	4.1	12.5
33.5	4.6	12.5
38.4	4.9	7.3
Average g (m/s ²)		10.6

From Teachers For Teachers

A constantly enriched digital repository has been created that offers information about the theoretical background of the phenomenon, simulations, the materials used in the project, photos, videos and educational worksheets.

<https://sites.google.com/view/scienceonstage2022>



It is the first time in Secondary Education that strobe light is used in this way. It is a novice, low-cost experimental set-up, that you can easily try with your students in the school lab!