THE NEW WANDERINGS

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This edition was originally slated for *Wanderings #171* in the **Citizen Scientist**. But since it ceased publication in May 2010 #171 was never used. I've decided to up date it and present it as ***New Wanderings #4 for July 2011***. Enjoy!

Note: its vacation time, therefore August's New Wanderings may be late.

Feature:

For this month's Feature we will be looking at the **Arduino microcontroller.**

Microcontrollers are small computers, often housed on a single chip, that are capable of performing many types of programmed tasks. One common function, of the device, is to replace a circuit made up of a complex array of discrete logic gates by a computer program. An advantage of this is that the application can easily be modified by changing some program code instead of doing actual hardware modifications.

Before we go too far, I'd like to mention that the Arduino is not the only show in town. There are many excellent systems, on the market, with vastly different features so you should be able to find one that fits your needs.

You have probably come across several of the most popular:

- **BASIC Stamp and Propeller** from **Parallax**

- **Picaxe** based on **Microchip Technology Inc's** PIC family of micro controllers.

- **MakeController Kit v2.0** from **the Maker Shed**.

Recently, I came across NGX Technologies' **BlueBoard-LPC1768-H** which looks quite impressive.

A few of the reasons that I like the Arduino are:
- There is a large user presence on the Web
- It has a small foot print
- Its architecture is "**open source**"
- There are a large number of "daughter boards" or "shields" available
- There is a **SD shield** available that gives several gigs of data storage.

Is there anything that I do not like about it? Yes, I wish that there was a mounting hole at each corner. Other than that, I haven't found anything more. Granted, I have not had too much time to "play" around with my board.

The Arduino Home Web Site
The current basic Arduino, the **Duemilanove**, is built on the **Atmel ATmega328 chip. Duemilanove** means 2009, in Italian, the year that it was released.

AVRFreaks
The AVRFreaks host discussions on the ATmega386 and other Atmel products.

Getting Started with Arduino
This book was written by Massimo Banzi, one of the Arduino developers, and is a good place to start.

The Arduino Tutorial Bundle
This is a collection of 11 tutorial experiments.

Here are a few of the many sites that host Arduino project collections:
- **The World Famous Index of Arduino Knowledge**
- **10 DIY Arduino Projects and HOW - TO - Tutorials**
- **The Arduino @ Instructables**
- **The Arduino @ YouTube**
- **Electronics Lab --- Arduino Projects**
- **Hack a Day --- 301+ Arduino Projects**
- **uCHobby --- Arduino Projects**
- **Introduction to Microcontrollers with Arduino**
- **The Arduino as I2C bus scanner and other projects**

The Arduino @ Goggle Code
This project is a home for the development of the Arduino platform.

An Arduino based Liquid ID Spectrometer
Eric Rosenthal designed and built that can be adapted for either transmissive or reflective modes. See *Wanderings #160, 03 July 2009* for further information.

The pHduino
Carlos Neves built a pH meter that is controlled by an Arduino.

Arduino Controlled Magnetic Stirrer
An Arduino is used to control a magnetic stirrer.

An Arduino RC Lawnmower
Summer is here. Why not be lazy and let an Arduino mow your lawn?

Secrets of Arduino PWM
In a **PWM** or Pulse Width Modulation signal the frequency is constant, but Time On/Time Off or duty cycle can be varied between 0 and 100%.

Arduino Based Serial RC Servo Controller
Here is an Instructable that shows how to control **RC type servos** with an Arduino.

Arduino "RADAR"
Use an Arduino and a SRF-05 ultrasound range finder to make a radar.

The Reverse Geocache Puzzle
This Arduino / GPS based puzzle box will not open until its owner figures out where on earth to move it. Follow the Puzzle Box saga on **Arduiniana**.

Ferret
Ferret was a high altitude balloon tracker that was constructed, in an afternoon, for a balloon launch (Project Orion) from Churchill College, Cambridge.

Arduino RFID Door Lock
An Arduino is used to control a keyless lock.

Arduino Sound
Part 2 --- **Hello World**
Part 3 --- **Playing a Melody**

LCD's and the Arduino
This link shows how to connect a LCD display to an Arduino.

4 Digit 7 Segment Display
The Maker Shed has a 4 digit display circuit board available for $50.

Ferret
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Digital Camera Control Using Arduino
In many modern digital cameras, the USB port can be used not only for transferring images to a PC, but also for sending control commands to the camera.

Arduino-Based GPS Camera
This camera was designed by **Flickr arms22** and includes a **LS20031 GPS** receiver, a **C328** 640x480 camera module and a SD card to store images. Unfortunately, it's mostly in Japanese. But you might be able to glean some information from it. Give it a try. Here is some of **Flickr arms22's other work.**

Hack a Keychain Digital Camera
This Instructable shows how to control a small digital camera with a microprocessor.

Arduino I/O Pin Performance
Here is the sketch that was used to measure how often a pin I/O command can be issued.

Solarbotics Ardweeny
This is a stripped down tiny version of the Arduino.

How to build the Ardweeny
The Ardweeny is a microcontroller that has the foot print of a single chip.

The Arduino Proto Shield
Here is an open-source prototyping shield for the Arduino.

An Arduino Board Layout Library
This collection of board layouts, in **Eagle** format, is available for download at **Adafruit.com**.

The EyeWriter

Q-Breach has developed a low-cost eye-tracking apparatus that allows a person with paralysis resulting from Amyotrophic Lateral Sclerosis to write or draw using only their eyes.

The Eye Shield

The Eye Shield is a circuit board that allows the Arduino to have the power of sight. It interprets analogue video (**PAL or NTSC**) from a camera or other source.

Core2duino

See how to build an Arduino shield that adds another Atmega 168/328 on top of your Arduino,

Core3duino

As if the Core2 wasn't enough ----

I²C (Inter-Integrated Circuit)

I²C bus is a multi-master serial single-ended computer bus that is used to attach low-speed peripherals to a motherboard.

The Philips I²C Bus Manual

In this manual, Phillips gives a detailed explanation of the I²C bus.

Expand the Arduino I/O with the I²C bus

Try the I²C bus with your Arduino application.

The Arduino

So, where can you buy an Arduino?

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Wanderings:

Make Your Own Organic Light Emitting Diode (OLED)

A DIY LED is only one many excellent projects that can be found at the University of Wisconsin's **Video Lab Manual**. Take some time wander around the rest of their site as there is a lot of good stuff there such as --- **Exploring the Nanoworld with LEGO® Bricks**.

The Bradford Robotic Telescope

The Bradford Robotic Telescope is a collection of telescopes and other instruments that is located on Mount Teide, **Tenerife**.

Tho X. Bui's Solar Catenary Reflector

Tho X. Bui briefly describes his Solar Catenary Reflector, in Issue #21 of **Make: Magazine** but his Web Site covers his reflector in much greater detail.

Intro to RFID

This Instructable gives you step-by-step instructions for 15 different fun RFID projects.

The Icarus Project

Here are the **amazing pictures** of Earth captured by Robert Harrison, a balloon and his compact camera. Have a look at **Robert's pictures on Flicker**.

The Balloon Project: San Francisco

Robert's work is a bit more advanced than **the Balloon Project**.

99 Luftballons

All these balloons reminded me of Nena's song ☺ And NO --- it's not "99 RED Balloons"!

A DIY Cloud Chamber

The main part of this DIY cloud chamber is a **Peltier Cooler** semiconductor device.

Build a CD Spectrograph

A cardboard box + an old CD = a DIY Spectrograph.

The Baghdad Battery

Did the ancient Assyrians use electricity?

Build a DIY Hydrophone.

The **Panasonic WM-61A** microphone capsules that are used in this project were found on **eBay**.

Conductive Glue, Paint and Thread

These DIY conductive items should prove useful to the experimenter. How about making a, **papier-mâché**, high voltage terminal for a Vann de Graaff generator?

A Passive Infrared (PIR) Motion Sensor

A tutorial from **Adafruit**

How to Build a Small Fume Hood for Stinky Projects

Many activities, related to amateur science, "stink" so it might be advisable to make use of a **fume hood**.

But, before you roll up your sleeves and start construction of your hood you should look at the **Fume Hood Standards** from the University of Waterloo and take special note about using spark free electrics (fans / switches / etc) if you ever intend on using substances that give off flammable vapours.

You could also expand the fume hood into a combination with **a glove box**. I wanted to give you a link to a better DIY glove box but unfortunately, the best one that I found was on a DIY Designer Drug site and for obvious reasons I did not want to link to it.

TeleToyland

You will be able to use these web connected applications to reach out on the Internet's virtual world and affect the real world. See how TeleToyland's **Marble Maze** was built.

Inkscape

This is a free open source vector graphics editor, with capabilities similar to Illustrator or CorelDraw.

VirtualBreadboard

Download your *free* copy. Virtual Breadboard is an easy to use virtual simulation tool that can be used in place of a real breadboard to quickly model electronic and microcontroller applications. Now it is equipped with a virtual **Arduino**!

Raven Lite

This is another *free* software program. Raven Lite, from the Cornell Lab of Ornithology, that lets users record, save, and visualize sounds as spectrograms and waveforms. Raven Lite is intended for students, educators, and hobbyists, and can be used for learning about sounds, as an aid in birdsong recognition, and in musical instruction. **Download your copy of raven Lite**.

Controlling Small Variable Speed Motors

Use your PC's serial out put to control a small variable speed motor.

The H-Bridge

Chuck McManis shows a simple way to control a bi-directional DC motor.

A Better H- bridge
>Eugene Blanchard shows his design for a more robust H-Bridge.

Basic Testing of Semiconductor Devices
>Samuel M. Goldwasser shows us how to test many semiconductor devices.

GO/NO GO Test of MOSFET Transistors
>With a suitable digital multi-meter, you should be able to do a fairly accurate GO/NO GO Test on MOSFET transistors.

DIY 3D Milling Machine
>See this homemade mill at **Max's Little Robot Shop**.

Communicate With a Roomba Via a Serial Link
>Do you know that your Roomba vacuum cleaner can form an excellent robot platform?

Hydraulic Ram Pump
>This pump requires no energy input except gravity. One down side, it requires a **head** of at least 1 metre in order to work.

Is Our Response to Music Hard-Wired or Culturally Determined?
>Investigate the question with Bobby McFerrin in *Notes & Neurons* at the **The World Science Festival.**

Digital Signal Processing
>Digital Signal Processing (DSP) is a tool that is used to process signals (or data) by digital means.

Digital Signal Processing Tutorial
>This is one of the tutorials from the extensive collection at **101 Science**.

Signal Analysis/Processing Software
>This is only for those of you who are running a Linux system.

Acoustics and Vibration Animations
>Dr. Dan Russell's site contains animations which demonstrate various concepts concerning acoustics and vibration. I especially like this visualization of **Longitudinal and Transverse Wave Motion**.

A Modified Didgeridoo
>Kyle Evans extends the versatility a **didgeridoo** with signal processing software.

The Turing Machine
> Mike Davey built this excellent example of a Turing Machine. The concept was originally the result of a "thought experiment" by **Alan Turing**, one of the fathers of the computer age.

A Turning Machine Simulation
> Try your hand at programming with this Java applet.

Educypedia
> Educypedia is an information resource about Scientific and Educational material such as Electronics, Science, Engineering, Encyclopedia and Information Technology.

Integrated Publishing
> The Integrated Publishing site contains a wealth of assorted information such as a section on **Radiation Detection Technology**. Some of the items are free while others are available as user pay subscription service.

Intute
> Here is a free online service that can help you to find the best web resources for your studies and research

GRID-Arendal
> GRID-Arendal is an official United Nations Environment Programme (UNEP) collaborating centre, supporting informed decision making and awareness-raising

Dr. David R. Brooks, whose site I included in **Wanderings #169**, has alerted me to a couple of interesting links that are located on his site:

- This application, a **Simple Model of Solar Irradiance or Insolation**, is an approximation that provides some insight into the basic physical processes that control the amount of sunlight reaching Earth's surface under "clear sky" conditions.

- **The Bird and Hulstrom's Solar Irradiance Model** is widely used for estimating broadband clear sky irradiance at Earth's surface.

The Vostok Ice Core
> In January 1998, an ice-drilling project at the Russian Vostok station, in East Antarctica, produced the deepest ice core ever recovered, reaching a depth of 3,623 m and has yielded a 400000 year profile of **Temperature and Atmospheric CO2 Concentrations** .

AccuWeather.com Global Warming Center

      This site offers links to some of the latest research and commentary by experts from both sides of the global warming / climate change debate. For example **Evidence Suggests Man-Made Warming Greatly Exaggerated**.

Patent Medicines

      These are medical compounds of questionable effectiveness that are sold under a variety of names and labels

Join the Conversation on the Future of Science in the US

      The white house wants to hear from you!

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The Kids Room:

SURFING the NET with KIDS

      This site offers a vast collection of resources for kids. Have a look at their **Science Section**. They even have a selection of **Science Games** such as **Assembler**.

Physics 2000

      Physics 2000 is a collection of interactive physics demos that make extensive use of Java applets. Try running the **Double Slit Experiment** for yourself.

Infamous Double Slit Experiment

      This is a detailed explanation of the Double Slit Experiment in the form of a YouTube video.

It's Alive!

      Collin shows that you can have fun with corn starch and water.

NCH Tone/Waveform Generator

      You could use this free waveform generator, with a suitable amplifier and speaker, to create your own "corn starch monster".

Experiments in Psycho-Acoustics

      Does the ear and brain mix signals?

How to make an Awesometastical PVC Flute

      You can turn a short length of PVC pipe into a working music instrument.

Funology
Have fun with science!

The Science Explorer
Here is an on-line book of home science experiments from San Francisco's **Exploratorium.**

What is the Game of Life?
Explore the wonders of math with *The Game of Life*, *Spirograph, Mazes* and much more.

The Little Shop of Physics
This group of science educators and students travel their region with a van full of hands-on experiments teaching people that science is something that anyone can do.

The Rubik's Cube
How fast could you solve it?

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Women in Science:

Sarah Flannery
In 1999, a 16-year-old Irish girl, won the **Esat Young Scientist Exhibition** and the **EU Young Scientist of the Year Award** for her project entitled *"Cryptography - A new algorithm versus the RSA"*. Her paper described her discovery of the **Cayley–Purser Algorithm.** Even though she later reported that the algorithm was flawed the whole thing attracted considerable media attention.

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Random Samples:

The Bhut Jolokia Is The World's Hottest Chili Pepper
In 2007, **Guinness World Records** certified the Bhut Jolokia as the World's hottest chilli with a **Scoville rating** of between 855,000 and 1,050,000.

When a Phillips is not a Phillips!
> This is an excellent example of the myriad of different screws that are available. There seems to be as many screw types as there are stars in the sky.

When a Phillips is not a Phillips Plus So Much More!
> If the previous wasn't enough, there are even more types of screws!
>
> Personally, I strongly dislike Phillips, Posidrive, Reed and Prince or any other "cross" head screws. In fact, I refuse to use them unless forced to under pain of death – Well not quite ☺ --- My preference is the **Robertson**.

Alt Codes
> The Alt Codes is a collection of 256 decimal numbers that give the user access to characters that are not normally available on the standard PC keyboard.

Anyone who is running a web site or contemplating doing so may be interested in the following sites:
- **Web Building Tutorials**
- **HTML Primer**
- **The HTML Code Tutorial**
- **Ted's Comprehensive HTML Tutorial**

A Stroll Through Pakistan's DIY Machine Gun Market
> The other side of DIY

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From The Far Side:

Locations of Some "Official" US Weather Observation Stations!
> It is utterly unbelievable that these are actually official sites.

The ADE651 Bomb Detection "Divining Rod" System
> The ADE651 is supposed to be able to detect IED's and other explosive devices. Here is a REAL **ADE651 promotional video**.

BBC Newsnight: UK Bans Exports of "Bomb Detecting" Dowsing Rods
> It seems that the ADE651's do not work.

The ADE651 aka Quadro Tracker
>**James Randi's** view of the ADE651.

Eric Krieg
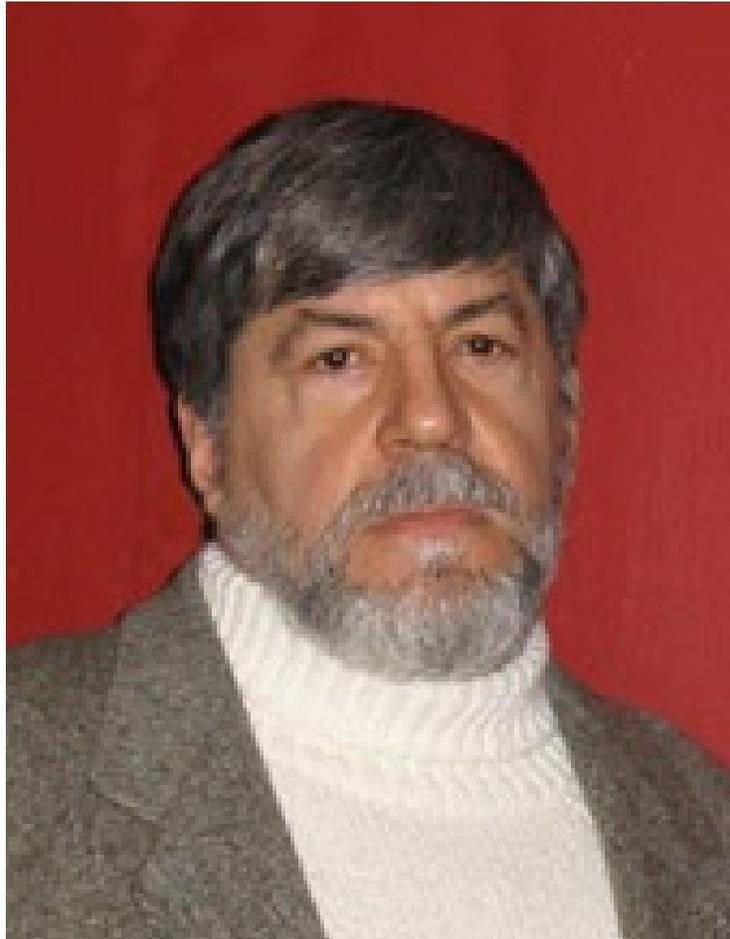>Eric follows the 'work" of Free Energy Gurus **Dennis Lee** and **Joe Newman**.

EarthTech International (ETI)
>ETI is a privately funded research organization dedicated to the exploration of new frontiers in physics.

The Beaty-tchison Effect
>**Bill Beaty** demonstrates antigravity ☺

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