ARDUINO

THE ULTIMATE BEGINNERS GUIDE TO ARDUINO - LEARN HOW TO GET STARTED WITH ARDUINO PROGRAMMING, PROJECTS AND MORE!

KEVIN GRAY

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Introduction

Let me ask you this question, I know it may be way before your time but do you remember the erector sets and circuit boards and all those neat little doodads we used to play with back when transistors and vacuum tubes were all the rage? Well if you do then you are probably older than I am because that stuff was just becoming extinct and the new digital age of technology was being born.

If you do however remember this time in your life then you will be happy to know that it is making a comeback with a new twist on old technology. I remember when I was a kid tinkering round with these little kits that really didn't do much but turn lights on and off, move small robots around and did stuff that was for the most part educational. In today's society kids don't know how things work and if something breaks they just throw it away and get something new.

Well, if you are someone who is interested in this type of stuff then the Arduino is probably something that you want to take a closer look at and even get your hands on.

With the Arduino you have a small circuit board made with modern technology that when combined with your thinking and innovation can do some pretty cool stuff. You can control lights, make wearable technology as well as a wide range of other tasks and projects. The Arduino however is a little more complicated to work with and may be a little more complicated to operate compared to other boards but if you are looking for a challenge you will want to get your hands on one.

In this book we will look at the Arduino as well as several other alternatives. We will talk about what you can do with it and you can't and even show you some cool projects that you can crate using this technology.

So if you are someone looking to adventure out into the world so science and technology and are not scared to get your hands dirty go ahead and start learning about this cool piece of technology.

Chapter 1 – Arduino 101

The world of computers and technology is a great place to play in. When we combine some basic technology and the creative juices of our imagination we can create amazing worlds driven by our thoughts and actions. For many years people have been using circuit boards, transistors, lights and now computers to power their ideas bring their visions to life.

In the birth of the 21st century many people have turned away from the exploration of technology to focus on what they can do with the newest and greatest gadget. When something becomes damaged or no longer functions it is discarded for the next best thing and don't attempt to fix simple five minute problems that could save them time and money.

In our modern age we are too focused on getting it now, using it to it serves no more purpose and going out and getting the better shinny object. There is, however, a few individuals who are on the other side of the coin. These are the explorers and the innovators. These are the people who like to learn and discover why as well as how things work.

These people are becoming a rare breed. Being pushed out of the way for modern commercialism these hobbyist now turn to the latest technology in order to quench an old school hunger.

With the development of modern technology has come a device that will allow those hobbyist to be a part of the past, live in the future and be more innovated and productive than ever before.

Introducing the Arduino.

The Arduino is a small circuit board device that has the basic power of a computer that will fit in the palm of your hand. The Arduino comes in several different models and when connected to external devices and controlled with some basic programming can do some amazing things.

The Arduino is a basic type of computer that will allow you to send inputs to it and receive outputs to an external device or vice versa. The Arduino is a little more advanced than some other micro boards on the market but can do a lot in the hands of a skilled programmer.

When looking at this device those who should play with it are people who have a higher skillset in electronics and some basic programming in languages such as C++. If you are a child or someone who wants a device or tool that is more user friendly I would suggest looking at the raspberry pi. The raspberry pi is more of a teaching tool to get kids and adults into the electronics space. If however you are more advanced and looking for a challenge then the Arduino is a good fit. Just know what types of projects that you are looking to create before jumping into purchasing these devices. You may quickly find that you bit off more than you can chew.

Okay, now that I have given you some basic pointers as to weather you should use this device or something similar such as a Raspberry Pi and you are still interested in the Arduino let's jump in and start tearing it apart.

Getting Started

If you are looking to get started there are a few things that you should know. First of all the Arduino is a great piece of technology that has been around for awhile and has a strong and growing community of users. If you are new to this then you will have some great support.

Second since this is a great community of people there are a lot of people offering up projects and other tools and resources that you can use to build your toys. The Arduino is open source which means that you can use the technology to do whatever you want. You can also take the hardware that is on the devices such as the chips and have a company in China design you your very own version of the board that you can use for specific projects and even build something to resell.

The third thing is that there are many different versions of the board. With it being open source the Arduino company has released several versions of their own boards as well as several other companies which can make some issues with compatibility with code and technology an issue so make sure you read up on all documentation and ask plenty of questions before purchasing a board.

As far as the boards are concerned they are very reasonable. You can purchase a board from around $15 - $25 US dollars. You can get a kit for around $50 and some more advanced boards and kits for around $300.00

It is my recommendation that you purchase the most basic kit that you can afford when first starting out. If you have some extra money to burn then go ahead and invest in a better board or kit or even purchase several different models t see what you can do and how they work.

To keep up to date with the latest news and technology with Arduino visit this web site. https://www.arduino.cc/

What makes up the Arduino?

When we look at the Arduino we have several different components. The first is Arduino itself. This is the main circuit board that you will use to prototype your creations. The board has several inputs, outputs, led lights, USB connector and power chips. These components allow you connect other components to it in order to create your projects.

You can connect power to the device by using either USB connector or with batteries. These sources of power will allow the device to turn on and run through its initial software code that is on the board.

Shields

When working with the Arduino you will want to have additional components and functionality that is not built into the base board. These additional components are called shields.

These shields are easily connect to the main Arduino and will communicate seamlessly together. When connecting these shields together there is no limit to the power and functionality you can create.

Programming your Arduino

When creating your projects you will need to program your device using C++. If you are not a programmer don't worry the language is fairly easily to learn and since the Arduino is all open source there is a huge community of users who have written code already for the device and have made it freely available for you to download, install, modify and make your own. With just a little time and effort you will quickly be able to create some projects with your device.

Open Source

One of the greatest things is that device and the software is all open source. What this means is that you have 100% control and freedom to make whatever and even sell whatever you make with these devices.

With is being open source the plans for the board are freely available so you could either make your own clone of the device and sell it with your name, send the plans to a developer in order to create you a special board that will run a specific project that you are creating or anything else you can dream of.

With it being open source you will have access to an entire community of people interested in your topics that can give you support as needed. This makes the Arduino a great tool for prototyping ideas and new projects.

What can you create with the Arduino?

The sky is the limit. If you can dream it you can make it. With the simplicity and the versatility of the hardware and the ease of use for the software as well as the amazing user community if you can dream it you can build it.

In the next chapter we will start exploring different projects others have done with the Arduino. We will give you resources to others who have taken the basic ideas and made amazing things.

Chapter Two – Ideas, Projects and More

In the previous chapter we talked about the basics of the Arduino. In this chapter we will start to dive deep into the hardware itself as well as the projects and ideas that people have been developing with this hardware. At the end of this chapter you will have a basic idea of what is possible as well as some great ideas for developing your very own projects.

Easy Project – Lightning Detector
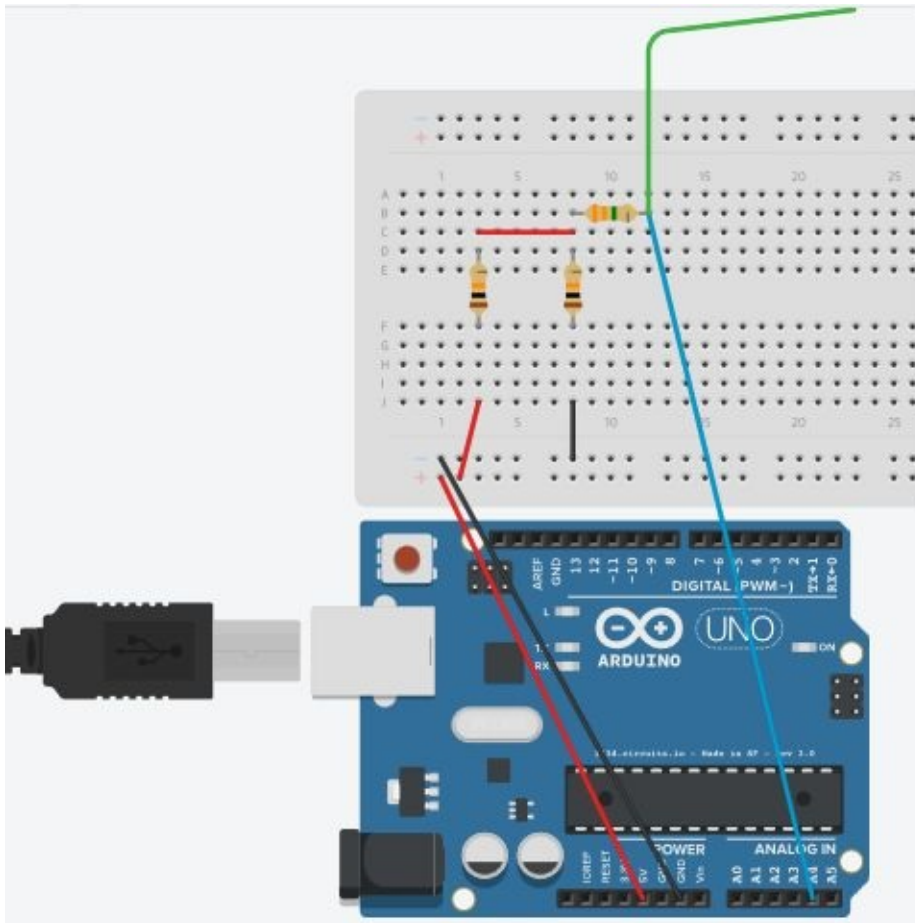
Here is how the project should look. Follow the image to create your own project. Listed below will be the parts needed and the sketch you will need to code in order to get the project to work.

Parts Needed – In order to create this project you will need the following components.

- 2x10k Ohms Resistor
- 1x 3.3M Ohms Resistor
- 4x jumper wires
- 1x Arduino (I'm using Uno but any other will work as long as it can operate at 16Mhz)
- Breadboard for simplicity

Code – Here is the code that you will need to get it to work. Feel free to play around with the code and make the desired modifications to the project you wish.

#define FASTADC 1

// defines for setting and clearing register bits

```
#ifndef cbi
#define cbi(sfr, bit) (_SFR_BYTE(sfr) &= ~_BV(bit))
#endif
#ifndef sbi
#define sbi(sfr, bit) (_SFR_BYTE(sfr) |= _BV(bit))
#endif
int data = 512;
int storage[512];
long batchStarted;
long batchEnded;
int reading;
int count;
int maximum;
int minimum;
bool toSend;
void setup() {
#if FASTADC
// set prescale to 16
sbi(ADCSRA,ADPS2) ;
cbi(ADCSRA,ADPS1) ;
cbi(ADCSRA,ADPS0) ;
#endif
  // put your setup code here, to run once:
  Serial.begin(115200);
  pinMode(A4,INPUT);
  Serial.println(micros());
  batchStarted=0;
  batchEnded=0;
  reading=0;
  count=0;
  maximum=0;
  minimum=1023;
```

```
  toSend=false;
 }


void loop() {
  // put your main code here, to run repeatedly:
  reading = (analogRead(A4));
  storage[count]=reading;
    if  ((!toSend)&&(count!=0)&&((reading>storage[count-1]+10)||(reading<storage[count-1]-10))){
    toSend=true;
  }
  count=count+1;
  if ((count == 512) && (toSend))
  {
    count=0;
    batchEnded = millis();
    sendData();
    batchStarted = millis();

  }
  else if (count==512){
    count=0;
    batchEnded = millis();
    //sendData();
    batchStarted = millis();

  }


}


void sendData()
{
```

```
  Serial.print(">>>");
  Serial.println(batchStarted);


 for (int i=0;i<data;i++){
   Serial.println(storage[i]);
 }
 Serial.print("<<<");
 Serial.println(batchEnded);
 Serial.println("END");


 toSend=false;
}
```

Idea #2 – A Bubble Machine

One cool thing about this project is that it can be a great learning experience for kids as well as adults. If you build two of them you can have bubble fights.

What you will need for this project are as followed.

1. Arduino Duemilanove $30.00

1 motor shield $19.50

2 micro servos- I used Hextronik HXT 500 $3.50 each

1 DC toy motor- something between 3v and 12v - easy to find, motor shield docs will help you decide if what you may already have will work.

1 bottle of bubble mix.

These things I used, but are not critical. This is where your own creativity will need to come to play.

1 roll of perforated metal tape- any hardware store

nuts and bolts of various sizes diamond plate- local scrap yard

aluminum channel- local scrap yard

1 threaded rod hanger/ plate

earthquake putty or museum wax

5 minute epoxy

1/4” acrylic sheet- about 6” x 6” worth

acrylic adhesive

Idea #3 = Mobile Dance Floor

This is a great idea if you are a DJ or someone who loves to dance. You can make the dance floor as big or as small as you want and if you are really creative you can put in a stripper pole or even come up with different ideas for using a floor that lights up.

I found the design for this project on the following site - http://www.raverover.com/ Go there to learn how to put the project together as well as get some other innovative ideas for making the most awesome party house you can.

Idea #4 – Secret Knock Door Knocker

This is a pretty cool idea and with a little modifications you can have some real fun with it. If you would like to get the information on this project visit this web site - http://www.instructables.com/id/Secret-Knock-Detecting-Door-Lock/

When developing the door knocker you can make some modifications to the body. You can try placing the device in a mask and hang it on the door so that when people approach the head will open and close its mouth. You can get a motion sensor that when tripped will play an MP3 file or perhaps trigger the door itself to open.

When doing this project there is a lot that you can do. It is all a matter of being creative.

Idea #5 – Finger print scanner

When you use the Arduino and some other basic components you can create a finger print scanner. You can attach this scanner to another piece of hardware that when recognizes your print will turn on or off, sound an alarm or with the wireless components send a signal to a fleet of drones that you can use to attack your brother or sister.

When you do this type of project you can have something that increases security in your home can unlock a box or drop water balloons form overhead fighters. Ideas are limitless.

Idea #6 – Spray gun for the cats

One cool thing that you can do with the Arduino is attach motion and light sensors to it. When you do this and the lights are broken they can run a servo motor that will squeeze the trigger of a spray bottle sending water onto that pesky cat when he or she jumps on the couch. You can take this basic idea and use it in a wide variety of operations.

Idea #7 – Build Robots

Robots are a great thing to build. You can create your own Terminator to go after your sister or the cat. With robots you can program them to do a wide variety of tasks. There

are a group of guys that programmed their device to play poker. What they did was create a robotic arm that had a suction cup at the end of the hand. They also programmed it to follow specific movements as well as react to a wide variety of commands. The robot would then use this information to deal out the cards as well know when to hit, stay and fold.

Idea #8 – Create your own futuristic control panel

If you are a lover of science fiction and shows like Star Trek like I am then you will really enjoy this project. http://imgur.com/a/DyQZL#TPXOq0n

In this project you will create a futuristic control panel that you can use to control your computer as well as other devices. When I saw this project I thought it was pretty cool and I plan on building something like this myself. With this project you will be able to control aspects of your computer, models made with other makers sets and much more.

I highly suggest that you check out this project. It will make your home computer the most awesome computer in the neighborhood.

Project #9 – Mood lamps

When it comes to the Arduino you have the ability to modify the voltage and other aspects of power going to LED lights. With this capability you can create some pretty cool mood lighting. If you add in a voice and text sensor as well as the language dictionary you will have over two million words and commands that you can use to create some pretty cool effects.

Project #10 – Create some simplistic games

The Arduino is not a very powerful device when it comes to playing games. If you want to create your own personal gaming system you may want to look into the Raspberry pi. But you will be able to do some basic games with the Arduino. One of the games that is featured is Pong.

Pong is a very basic game that will allow you to use some basic controls and code to move the ball and panel around the screen. If you want something fun to play why not make this device.

Project #11 – Laser Turret

This is a pretty cool thing to make and if done right can really mess with the cat. Here are some of the items that you will need.

2 servos

Laser module

Piezo buzzer

Metal wire and cable ties

When you connect these devices to the Arduino you are creating a device of mass destruction and chaos in your home. Be careful where you point your lasers.

Add-ons that you can purchase for your Arduino

When it comes to developing different projects the ones that I listed above are pretty cool but you will more than likely want to develop your own projects and play around with the different things that are available.

Listed below are going to be some of the cool additional product and items that you can purchase to make your own projects. I hope that my list of choices will get your imagination pumping.

Magic light cup module KY-027

When playing with light sensors you can cause a lot of different things to happen. For example you can hook the sensors up to inferred lights so that when a light gets to a certain brightness the lights will go on and give uv light to your plants. When playing with lights there are countless options.

Here is some sample code that you can use to play with the light sensor.

```
int LedPinA = 5;

int LedPinB = 6;

int ButtonPinA = 7;

int ButtonPinB = 4;

int buttonStateA = 0;

int buttonStateB = 0;

int brightness = 0;

void setup ()

{

pinMode (LedPinA, OUTPUT);

pinMode (LedPinB, OUTPUT);

pinMode (ButtonPinA, INPUT);

pinMode (ButtonPinB, INPUT);

}

void loop ()

{

buttonStateA = digitalRead (ButtonPinA);
```

```
if (buttonStateA == HIGH && brightness! = 255)
{
brightness + +;
}
buttonStateB = digitalRead (ButtonPinB);
if (buttonStateB == HIGH && brightness! = 0)
{
brightness -;
}
analogWrite (LedPinA, brightness); / / A few Guan Yuan (ii)? analogWrite (LedPinB, 255
- brightness);
/ / B Yuan (ii) a few Bang?
Delay (25);
}
```

Rotary encoder module KY-040

Here is another cool light sensor that you can use. Listed below is some sample code that you can use to play with this device.

```
#include <Arduino.h>


// ————————————————————
// constants


const int                    PinCLK  = 2;    // Used for generating interrupts using CLK
signal
const int                    PinDT   = 4;    // Used for reading DT signal
const int                    PinSW   = 8;    // Used for the push button switch


// ————————————————————
// global vars
```

```
volatile int                 virtualPosition   = 0;


// ——————————————————————
// forward decls


void isr();
void loop();
void setup();


// ——————————————————————
// Interrupt service routine is executed when a HIGH to LOW transition is detected on
CLK


void isr ()  {
   if (!digitalRead(PinDT))
   virtualPosition = virtualPosition + 1;
   else
   virtualPosition = virtualPosition - 1;
   } // isr


// ——————————————————————


void setup() {
   Serial.begin(9600);


   pinMode(PinCLK,INPUT);
   pinMode(PinDT, INPUT);
   pinMode(PinSW, INPUT);


   attachInterrupt(0, isr, FALLING);     // interrupt 0 is always connected to pin 2 on
Arduino UNO


   Serial.println(“Start”);
```

```
    } // setup

// ——————————————————

void loop() {

    int                          lastCount = 0;

    while (true) {
    if (!(digitalRead(PinSW))) {        // check if pushbutton is pressed
    virtualPosition = 0;            // if YES, then reset counter to ZERO
    while (!digitalRead(PinSW)) {}  // wait til switch is released
    delay(10);                  // debounce
    Serial.println("Reset");        // Using the word RESET instead of COUNT here to find
out a buggy encoder
    }
    if (virtualPosition != lastCount) {
    lastCount = virtualPosition;
    Serial.print("Count;
    Serial.println(virtualPosition);
    }
    } // while
    } //loop
```

Optical broken module KY-010

Detect the heartbeat module KY-039

Reed module KY-025

The Reed module is another cool device that you can use to play with lighting and other devices. Here is some sample code that you can play with when using this device.

int Led = 13 ;/ / define LED Interface

int buttonpin = 3; / / define the Reed sensor interfaces

int val ;/ / define numeric variables val

```
void setup ()
{
pinMode (Led, OUTPUT) ;/ / define LED as output interface
pinMode (buttonpin, INPUT) ;/ / output interface as defined Reed sensor
}
void loop ()
SunFounder{
val = digitalRead (buttonpin) ;/ / digital interface will be assigned a value of 3 to read val
if (val == HIGH) / / When the Reed sensor detects a signal, LED flashes
{
digitalWrite (Led, HIGH);
}
else
{
digitalWrite (Led, LOW);
}
}
```

Obstacle avoidance sensor module KY-032

This is a pretty cool piece of technology that you y want to get when playing and designing robots or other types of vehicles. When you connect this device to your Arduino you will be able to create some futuristic vehicles and robots that will move across the floor.

Here is some sample code that you can use to work with this device.

```
int Led = 13 ;// define LED Interface
int buttonpin = 3; // define the obstacle avoidance sensor interface
int val ;// define numeric variables val
void setup ()
{
  pinMode (Led, OUTPUT) ;// define LED as output interface
  pinMode (buttonpin, INPUT) ;// define the obstacle avoidance sensor output interface
```

```
}
void loop ()
{
  val = digitalRead (buttonpin) ;// digital interface will be assigned a value of 3 to read val
  if (val == HIGH) // When the obstacle avoidance sensor detects a signal, LED flashes
  {
    digitalWrite (Led, HIGH);
  }
  else
  {
    digitalWrite (Led, LOW);
  }
}
```

Hunt sensor module KY-033

Microphone sound sensor module KY-038

So far we have been playing with light but here is something cool you can use when playing with sound. With the microphone sensor you can create spy robots, noise detectors and much more.

Digital Output Code –

```
int Led = 13 ;// define LED Interface

int buttonpin = 3; // define D0 Sensor Interface

int val = 0;// define numeric variables val


void setup ()
{
  pinMode (Led, OUTPUT) ;// define LED as output interface
  pinMode (buttonpin, INPUT) ;// output interface D0 is defined sensor
}


void loop ()
{
  val = digitalRead(buttonpin);// digital interface will be assigned a value of pin 3 to read
```

```
val
  if (val == HIGH) // When the sound detection module detects a signal, LED flashes
  {
    digitalWrite (Led, HIGH);
  }
  else
  {
    digitalWrite (Led, LOW);
  }
}
```

Analog Output Code –

```
int sensorPin = A0; // select the input pin for the potentiometer
int ledPin = 13; // select the pin for the LED
int sensorValue = 0; // variable to store the value coming from the sensor

void setup ()
{
  pinMode (ledPin, OUTPUT);
  Serial.begin (9600);
}

void loop ()
{
  sensorValue = analogRead (sensorPin);
  digitalWrite (ledPin, HIGH);
  delay (sensorValue);
  digitalWrite (ledPin, LOW);
  delay (sensorValue);
  Serial.println (sensorValue, DEC);
}
```

Laser sensor module KY-008

5V relay module KY-019

Temperature sensor module KY-001

Temperature sensor module KY-028

The temperature sensor can be a really cool item to work with. If you can hook it up to a switch in your home you can turn on ceiling fans, air conditioners and more. You will also be able to show the temperature on a LCD or other display screen with some simple code.

```
int Led = 13 ;/ / define LED Interface

int buttonpin = 3; / / define the digital temperature sensor interface

int val ;/ / define numeric variables val

void setup ()

{

pinMode (Led, OUTPUT) ;/ / define LED as output interface

pinMode (buttonpin, INPUT) ;/ / define digital temperature sensor output interface

}

void loop ()

{

val = digitalRead (buttonpin) ;/ / digital interface will be assigned a value of 3 to read val

if (val == HIGH) / / when the digital temperature sensor detects a signal, LED flashes

{

digitalWrite (Led, HIGH);

}

else

{

digitalWrite (Led, LOW);

}

}
```

Linear magnetic Hall sensors KY-024

Flame sensor module KY-026

Sensitive microphone sensor module KY-037

Temperature and humidity sensor module KY-015

XY-axis joystick module KY-023

Here is something that is pretty cool and if you want to be able to crate your own game controllers this is something that you will want to look into. Joysticks are great ways to interact with games and to be able to design and develop your own game controller and actually control games with it will be a massive advantage over other players.

Also if you create a cool looking controller your friends will want you to design them one and this could turn into a great little business for you. Just an idea.

Here is some sample code that you can use to control the joystick controller

```
// Module KY023
// For more info see http://tkkrlab.nl/wiki/Arduino_KY-023_XY-axis_joystick_module
int JoyStick_X = A0; // x
int JoyStick_Y = A1; // y
int JoyStick_Z = 3; // key
void setup ()
{
  pinMode (JoyStick_X, INPUT);
  pinMode (JoyStick_Y, INPUT);
  pinMode (JoyStick_Z, INPUT_PULLUP);
  Serial.begin (9600); // 9600 bps
}
void loop ()
{
  int x, y, z;
  x = analogRead (JoyStick_X);
  y = analogRead (JoyStick_Y);
  z = digitalRead (JoyStick_Z);
  Serial.print (x, DEC);
  Serial.print (“,”);
```

```
  Serial.print (y, DEC);
  Serial.print (",");
  Serial.println (z, DEC);
  delay (100);
}
```

Metal touch sensor module KY-036

The touch sensor is another great little add-on that you can use for your Arduino. With the touch sensor you will be able to use a touch screen to interact with your creations.

Here is some sample code that you can use for this device.

```
int Led = 13 ;/ / define LED Interface

int buttonpin = 3; / / define Metal Touch Sensor Interface

int val ;/ / define numeric variables val

void setup ()

{

pinMode (Led, OUTPUT) ;/ / define LED as output interface

pinMode (buttonpin, INPUT) ;/ / define metal touch sensor output interface

}

void loop ()

{

val = digitalRead (buttonpin) ;/ / digital interface will be assigned a value of 3 to read val

if (val == HIGH) / / When the metal touch sensor detects a signal, LED flashes

{

digitalWrite (Led, HIGH);

}

else

{

digitalWrite (Led, LOW);

}
```

Conclusion

Well there you have it. The Arduino in its simplistic glory. When it comes to developing your own pieces of hardware driven by custom code there is only a select breed of individuals who have the vision and the patience to do so.

When I was a kid I loved to put things together and make them work. I remember working with Lego cars in shop class. They would give us a bunch of Lego blocks, some wheels and a bunch of other pieces and parts and was told to make something cool. I remember sitting there creating some elaborate ship or futuristic car that when finally wired up would streak across the room with flashing lights and sounds.

As I wrote this book those memories of years gone by filled my memories and actually brought me back to my childhood. With the development of the Arduino the tradition continues for yet another generation.

If you are looking to purchase one of these devices or even several of these devices they are a great way for you to bond with your children, improve their education and give them a way to start using creative thinking to solve problems and create amazing devices out of their imagination.

Isn't that what this is all about. Being able to take an idea, sketch it out on a pieces of paper, design some basic coding that will send electrical impulses to some hardware and make something me alive. Dr. Frankenstein eat our heart out.

As I end this book I want you to take a step back and really remember those projects that you created when you were a kid. Try to recreate them with the technology of today and even improve on them to the point that no one ever thought they could.

Thank you for taking your time to read this book. It was a pleasure to write and I hope that it has been useful. If you like this book please leave a favorable review so that others can learn about this book and all of the cool stuff inside. Also, if you liked this book look for my other books. They are all filled with great information on a wide variety of topics.

Thank you once again and as always, to your success!