Control Your Robot Using a Wii Nunchuck (and an Arduino)

by **oomlout** on December 17, 2008

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Intro: Control Your Robot Using a Wii Nunchuck (and an Arduino)

After wearing myself out playing Wii Boxing I got to thinking wouldn't it be great if I could use this to control my robot, (looking to my left hand).

Looking around the internet I found a bevy of people doing similar things, (links to everyone just below the video). So what follows is a re-packaging of all their hard work, resulting in a robot controllable by both the Wii nunchuck's joystick or more interestingly its accelerometers.

A quick video of my Arduino Controlled Servo Robot - (SERB) being controlled by a Wii nunchuck.

(resources)

- (here) - **Arduino Code** - Chad at WindMeadows.com has written excellent arduino code for reading the Wii nunchuck. Code which I have included pretty much verbatim in this project. if you're interested in more technical details this is where to look.
- (here) - **Nunchuck Details** - WiiLi.org has a great wiki about all things Wii, this is a link to a page that describes the nunchucks protocol and how to calibrate your nunchuck.
- (here) - **WiiChuck Adapter** - Tod of todbot.com very kindly produced a small adapter to make plugging your nunchuck into a breadboard particularly easy.

(similar projects)

- (here) - **Wireless Nunchuck Control** - Frank over at Society of Robots went one step further adding a wireless link so he can control his Arduino robot with all the tilt and twist fun from afar.
- (here) - **Nunchuck Controlled Pan and Tilt Camera** - Using a Nunchuck and an Arduino to control the pan and tilt of a camera.
- (here) - **Nunchuck and Arduino Controlled Canoe** - Finally a rather epic project that uses an Arduino, nunchuck, servos and small trolling motor to drive a Canoe.

(if you have an Arduino nunchuck project you've completed drop me a line and it can be added here)
(shameless plug)
To check out more of our lovely open source projects - oomlout.com

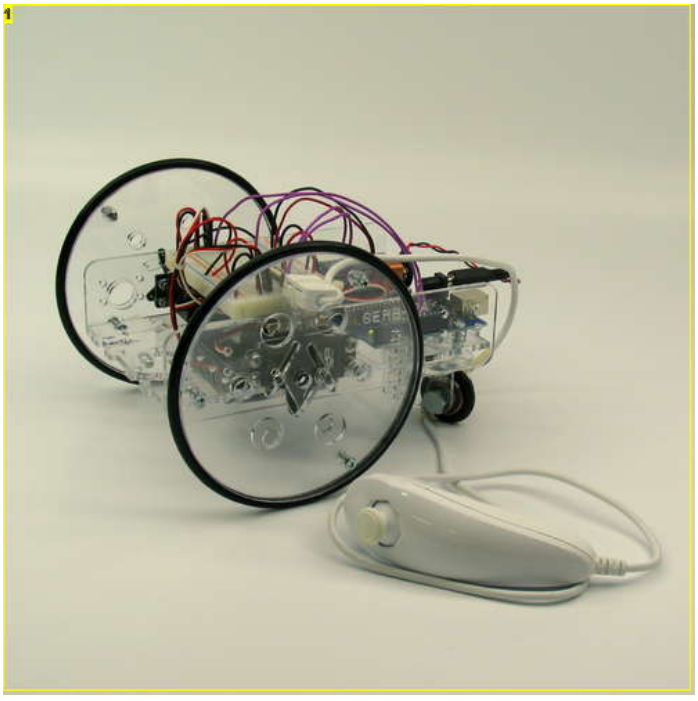


Image Notes
1. An Arduino Controlled Servo Robot - (SERB) - with Wii nunchuck attached.

Image Notes
1. An Arduino Controlled Servo Robot - (SERB) - with Wii Nunchuck attached in more natural surroundings.

Step 1: Parts & Tools

Only a few parts to collect before we get wiring and programming

Robot - (Arduino Controlled Servo Robot - (SERB))
(build your own , or purchase a lovely kit ($175)

- We use an Arduino Controlled Servo Robot - (SERB) however any Arduino powered dual servo robot will work. Other options (here)

Electronics - ($24)

- Wii Nunchuck - ($20) - (Amazon) , or at your closest Blockbuster or CircuitCity
- WiiChuck Adapter - ($4) - A small circuit board that allows you to plug your nunchuck into a breadboard without modifying it. *(if you don't want to use your nunchuck on your Wii you can save yourself four dollars and simply cut the connector off and plug the wires directly into your breadboard)* - (FunGizmos)
- Assorted pieces of Breadboard wire - (22 AWG solid)

That's it onto Wiring it up

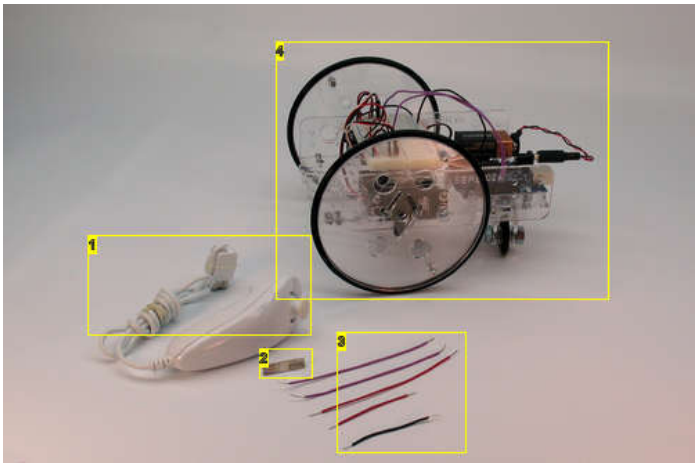


Image Notes
1. Wii Nunchuck - (x1) - Available online or from your nearest Blockbuster
2. Wiichuck Adapter - (x1) - Available from FunGizmos.com
3. A few Pieces of Breadboard wire (22 awg solid)
4. Arduino Controlled Servo Robot - (SERB) - build your own or kits available from oomlout.com

Step 2: Wiring

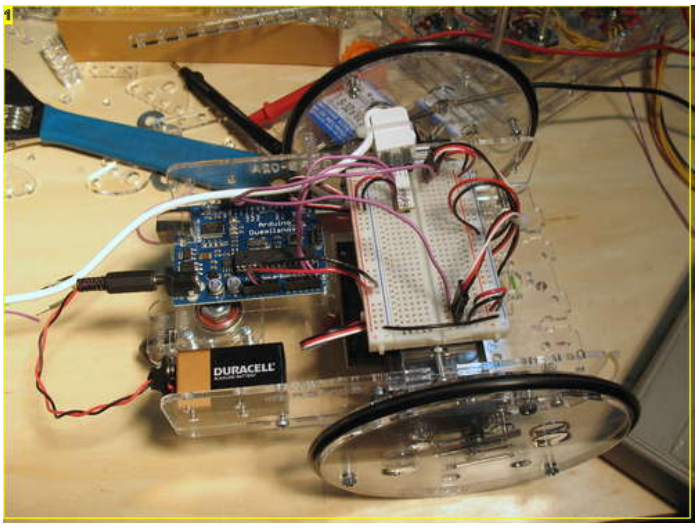
Wiring this up could not be simpler, and requires only four wires.

Explained

- **Data - (d) - (green)** - Arduino Analog 4
- **Clock - (c) - (yellow)** - Arduino Analog 5
- **Ground - (-) - (white)** - Arduino gnd
- **+3.3v - (+) - (red)** - Arduino 5v (although the Arduino is a 3.3 volt device it seems to work without adverse effects at 5 volts)

Pictorially

- refer to the attached wiring diagram (05-(NUSE)-Wiring Diagram.pdf)



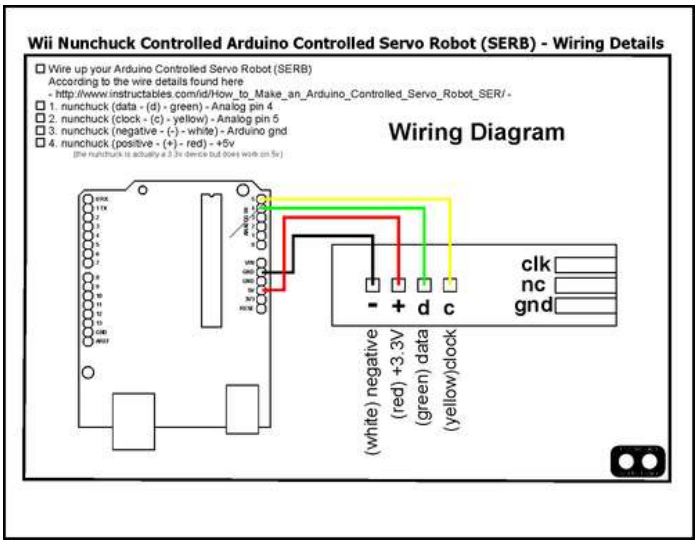


Image Notes
1. The breadboard as viewed from above

File Downloads

05-(NUSE)-Wiring Diagram.pdf ((612x792) 35 KB)
[NOTE: When saving, if you see .tmp as the file ext, rename it to '05-(NUSE)-Wiring Diagram.pdf']

Step 3: Programming

The Wii Nunchuck is now connected to the Arduino's i2c port. For those of you (including myself) who don't really understand what that means do not fret, just rest assured, it is a good thing. If you would like to know more of the nitty gritty details they can be found (here)

(many thanks to chad at windmeadow.com for doing the research and writing really easily understood Arduino code to interact with the Wii nunchuck, the program below includes his code virtually unchanged).

What it does

- The program will default to using the nunchucks joystick for control. If you push the stick forward your robot will go forward, reverse, backwards and so on.
- If you hold down the "Z" button (the big one on the front). Your robot will now move based on the tilt of the nunchuck. Tilt forward to go forward...
- Finally if it isn't quite working the program will send the state of the nunchucks buttons, joystick and accelerometers, every second over the Arduino's USB port. (just open the debug window at 9600 to see this data)

For those interested in simply getting it going.

Copy and Pasting

- Copy the Arduino code from below
- Paste it into the Arduino development environment.
- upload and start playing

Using the Code in Your Own Program

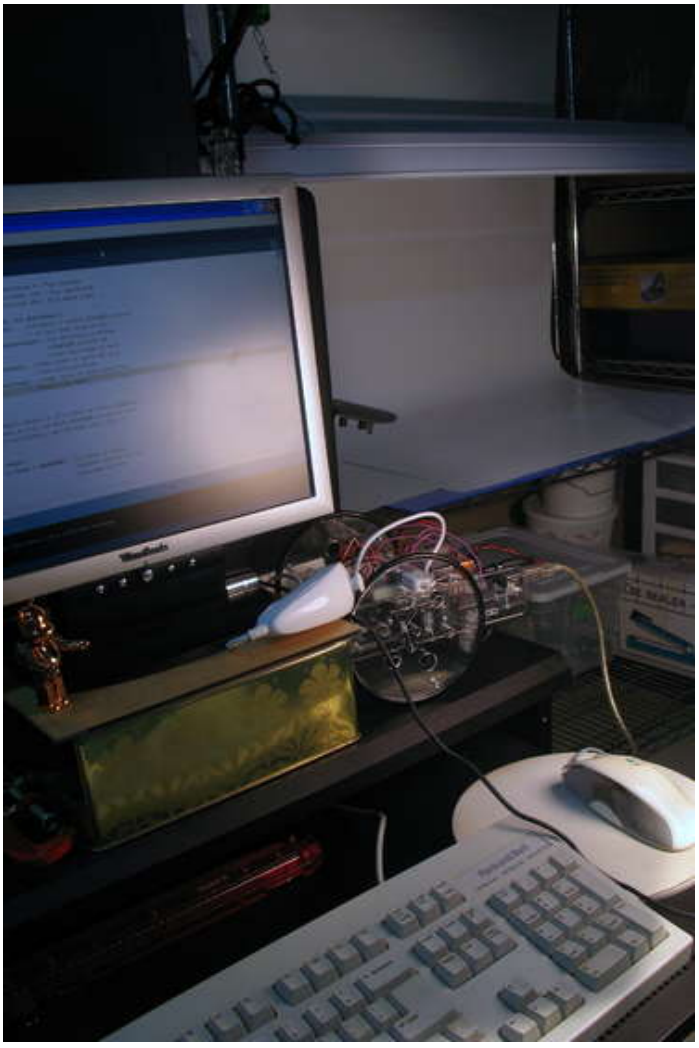
- First initialize the nunchuck by calling ***nunchuck_init ();***
- Next every time you wish to update the values of the nunchuck in your sketch call ***readNunchuck();***
- Next to directly access the values call ***getNunValue(Variable Constant);*** (ex. YAXIS)
- Finally if you wish to use the accelerometer but have it scaled to a number of Gs (ie. 1 g = 1 force of gravity). you can call ***getXGs();***, ***getYGs();*** or ***getZGs();***

Appendix 1 - _SERB_WiiNunchuckControl.pde

```
//START OF NUNCHUCK PREAMBLE - For more in depth information please visit the original source of this code http://www.windmeadow.com/node/42
//-------------------------------------------------
/*
* Wiring Details
* white  - ground
* red    - 3.3+v  - 5 volts seems to work
* green  - data   - Analog 4
* yellow - clock  - Analog 5
*/

#include  #include   #undef int #include   uint8_t outbuf[6];  // array to store arduino output int cnt = 0;                    // counter used for nu
       nunchuckValues[CBUTTON] = 0;

        // byte outbuf[5] contains bits for z and c buttons
        // it also contains the least significant bits for the accelerometer data
        // so we have to check each bit of byte outbuf[5]
       if ((outbuf[5] >> 0) & 1) { nunchuckValues[ZBUTTON] = 1; } //checking if Z button is pressed (0=pressed 1=unpressed)
       if ((outbuf[5] >> 1) & 1) { nunchuckValues[CBUTTON] = 1; } //checking if C button is pressed (0=pressed 1=unpressed)
       if ((outbuf[5] >> 2) & 1) { tempNun_xAxis += 2; } //adding second least significant bit to x_axis
       if ((outbuf[5] >> 3) & 1) { tempNun_xAxis += 1; } //adding least significant bit to x_axis
       if ((outbuf[5] >> 4) & 1) { tempNun_yAxis += 2; } //adding second least significant bit to y_axis
       if ((outbuf[5] >> 5) & 1) { tempNun_yAxis += 1; } //adding least significant bit to x_axis
       if ((outbuf[5] >> 6) & 1) { tempNun_zAxis += 2; } //adding second least significant bit to z_axis
       if ((outbuf[5] >> 7) & 1) { tempNun_zAxis += 1; } ////adding least significant bit to x_axis

       nunchuckValues[XAXISDELTA] = tempNun_xAxis - nunchuckValues[XAXIS];
       nunchuckValues[XAXIS] = tempNun_xAxis;
       nunchuckValues[YAXISDELTA] = tempNun_yAxis - nunchuckValues[YAXIS];
       nunchuckValues[YAXIS] = tempNun_yAxis;
       nunchuckValues[ZAXISDELTA] = tempNun_zAxis - nunchuckValues[ZAXIS];
       nunchuckValues[ZAXIS] = tempNun_zAxis;
   }
 cnt = 0;
 send_zero (); // send the request for next bytes
}

int getNunValue(int valueIndex){
 return nunchuckValues[valueIndex];
}

void nunchuck_init (){
 Wire.begin ();  // join i2c bus with address 0x52
 Wire.beginTransmission (0x52); // transmit to device 0x52
 Wire.send (0x40);  // sends memory address
 Wire.send (0x00);  // sends sent a zero.
 Wire.endTransmission (); // stop transmitting
}
```

```
void send_zero () {
 Wire.beginTransmission (0x52); // transmit to device 0x52
 Wire.send (0x00);  // sends one byte
 Wire.endTransmission (); // stop transmitting
}

// Encode data to format that most wiimote drivers except
// only needed if you use one of the regular wiimote drivers
char nunchuk_decode_byte (char x)  {
 x = (x ^ 0x17) + 0x17;
 return x;
}

//END OF NUNCHUCK CODE - For more in depth information please visit the
//original source of this code http://www.windmeadow.com/node/42
//---------------------------------------------------------------

//-------------------------------------------------------------------------
//START OF ARDUINO CONTROLLED SERVO ROBOT (SERB) ROUTINES

/*
* sets up your arduino to address your SERB using the included routines
*/
void serbSetup(){
 setSpeed(speed);
 pinMode(LEFTSERVOPIN, OUTPUT);     //sets the left servo signal pin
                                    //to output
 pinMode(RIGHTSERVOPIN, OUTPUT);    //sets the right servo signal pin
                                    //to output
 leftServo.attach(LEFTSERVOPIN);    //attaches left servo
 rightServo.attach(RIGHTSERVOPIN);  //attaches right servo
 goStop();
}


/*
* sets the speed of the robot between 0-(stopped) and 100-(full speed)
* NOTE: speed will not change the current speed you must change speed
* then call one of the go methods before changes occur.
*/
void setSpeed(int newSpeed){
 if(newSpeed >= 100) {newSpeed = 100;}     //if speed is greater than 100
                                           //make it 100
 if(newSpeed <= 0) {newSpeed = 0;}         //if speed is less than 0 make
                                           //it 0
 speed = newSpeed * MAXSPEED / 100;        //scales the speed to be
                                           //between 0 and MAXSPEED
}

/*
* sets the speed of the robots rightServo between -100-(reversed) and 100-(forward)
* NOTE: calls to this routine will take effect imediatly
*/
void setSpeedRight(int newSpeed){
 if(newSpeed >= 100) {newSpeed = 100;}     //if speed is greater than 100
                                           //make it 100
 if(newSpeed <= -100) {newSpeed = -100;}   //if speed is less than -100 make
                                           //it -100
 rightSpeed = newSpeed * MAXSPEED / 100;   //scales the speed to be
                                           //between -MAXSPEED and MAXSPEED
 rightServo.write(90 - rightSpeed);             //sends the new value to the servo
}

/*
* sets the speed of the robots leftServo between -100-(reversed) and 100-(forward)
* NOTE: calls to this routine will take effect imediatly
*/
void setSpeedLeft(int newSpeed){
 if(newSpeed >= 100) {newSpeed = 100;}     //if speed is greater than 100
                                           //make it 100
 if(newSpeed <= -100) {newSpeed = -100;}   //if speed is less than -100 make
                                           //it -100
 leftSpeed = newSpeed * MAXSPEED / 100;   //scales the speed to be
                                           //between -MAXSPEED and MAXSPEED
 leftServo.write(90 + leftSpeed);              //sends the new value to the servo
}

/*
* sends the robot forwards
*/
void goForward(){
leftServo.write(90 + speed);
rightServo.write(90 - speed);
}

/*
* sends the robot backwards
*/
void goBackward(){
leftServo.write(90 - speed);
rightServo.write(90 + speed);
}

/*
* sends the robot right
*/
void goRight(){
leftServo.write(90 + speed);
rightServo.write(90 + speed);
```

```
}

/*
* sends the robot left
*/
void goLeft(){
leftServo.write(90 - speed);
rightServo.write(90 - speed);
}

/*
* stops the robot
*/
void goStop(){
leftServo.write(90);
rightServo.write(90);
}
//END OF ARDUINO CONTROLLED SERVO ROBOT (SERB) ROUTINES
//------------------------------------------------------------------------------


//START  OF PRINT ROUTINES (can delete if not using)
//-----------------------------------------------------------------

//Prints the Nunchucks last read data (must call NUN_readNunchuck(); before calling
void printData(){
 Serial.print("XJoy= ");Serial.print (getNunValue(XSTICK), DEC); Serial.print ("\t");
 Serial.print("YJoy= ");Serial.print (getNunValue(YSTICK), DEC); Serial.print ("\t");
 Serial.print("XGs= ");Serial.print (getXGs() * 1000, DEC);  Serial.print ("\t");
 Serial.print("YGs= ");Serial.print (getYGs() * 1000, DEC);  Serial.print ("\t");
 Serial.print("ZGs= ");Serial.print (getZGs() * 1000, DEC);  Serial.print ("\t");
 Serial.print("ZBut= ");Serial.print (getNunValue(ZBUTTON), DEC);  Serial.print ("\t");
 Serial.print("YBut= ");Serial.print (getNunValue(CBUTTON), DEC);  Serial.print ("\t");
}

//END OF PRINT ROUTINES
//-------------------------------------------------------------------
```



Step 4: Finished

I hope you've gotten it working and are having fun tilting and driving.

If its not quite working leave a message or send us an e-mail at help@oomlout.com and we'll try our best to help you get it working.

(shameless plug)
For more fun open source projects try visiting us at oomlout.com

Related Instructables

Easy DIY Home Automation (using servo switches) by oomlout

Arduino Controlled Servo Robot (SERB) by oomlout

Wireless Wii Nunchuck controlled Arduino by XenonJohn

Angle measurement using gyro, accelerometer and Arduino by otaviousp

Using WiiChuck Adapter with Arduino by josestude

Wii Nunchuck as general purpose controller via Arduino board by XenonJohn

Comments

37 comments **Add Comment**

tmj61 says: Feb 7, 2011. 7:26 AM **REPLY**
Is the kit no longer available? when i try to go to the I "purchase a lovely kit" link it does not work.

Hoolaput says: Jul 22, 2009. 9:39 PM **REPLY**
why would you want to use the 5v if there's a 3v3 (3.3v) on the arduino beside the reset and 5v?

carlosanchez says: Aug 18, 2010. 5:12 AM **REPLY**
The 3.3V is supplied by the FTDI chip. Therefore it will only be available if the Arduino is powered via USB. If it is connecter to a battery, the chip will be bypassed.

Asuraku says: Nov 28, 2009. 6:27 PM **REPLY**

This code is an absolute mess and I can't seem to figure out how to fix it. Could someone post an un-scrambled working copy?

carlosanchez says: Aug 18, 2010. 5:08 AM **REPLY**

http://oomlout.com/tmp/SERB_WiiNunChuckControl.txt

Mdob says: Jan 13, 2010. 6:59 PM **REPLY**

Agreed, code is screwed; lets hope that Oomlout fixes it soon.

carlosanchez says: Aug 18, 2010. 5:09 AM **REPLY**

http://oomlout.com/tmp/SERB_WiiNunChuckControl.txt

jac.diamond says: Jul 10, 2010. 11:59 PM **REPLY**

Is the code posted alright? Im thinking of doing this but i dont want to buy the stuff until i know its alright.

carlosanchez says: Aug 18, 2010. 5:08 AM **REPLY**

I found the original code Here you go! http://oomlout.com/tmp/SERB_WiiNunChuckControl.txt

carlosanchez says: Aug 17, 2010. 7:07 AM **REPLY**

Hello! Would it be possible to post the code in a .pde file? The one pasted in the Instructable is scrambled in the beggining and is really hard to fix. Thanks!

Dannne11 says: Jul 14, 2010. 2:47 PM **REPLY**

how doe you connect the servos???

xava100 says: Jan 22, 2010. 11:44 PM **REPLY**

someone should try this with the classic controller since there isnt any other use for it

isambard1000 says: Nov 1, 2009. 12:56 PM **REPLY**

Hi Oomlout, the Arduino code seems to have got scrambled... can you repost it or email it to me. Thanks!

TXTCLA55 says: Sep 30, 2009. 6:09 PM **REPLY**

Hello again I just built the robot and well something is screwed up. I built it to your diagrams, pictures, and code and all I got was this:

http://www.flickr.com/photos/14462918@N03/3970656962/

The video pretty much shows the problem...NOTHING WORKS! By the way I just spent around $100 on this project and I was hoping that it would work.

tristantech says: Jul 23, 2009. 6:02 PM **REPLY**

If you want to save a few bucks but dont want to cut your nunchuck cord (it would be a shame to ruin such a nice toy) just take some double-sided copper clad board and use a dremel to carve traces like in the adapter the author used. I used to trick with a gamecube controller.

ZeusFury says: Jun 9, 2009. 8:27 PM **REPLY**

i think i am missing _SERB_WiiNunchuckControl.hex because i got this error ....FR0N58YFUI0OXF5_SERB_WiiNunchuckControl\applet_SERB_WiiNunchuckControl.hex': No such file...FR0N58YFUI0OXF5_SERB_WiiNunchuckControl\applet/_SERB_WiiNunchuckControl.cpp:133: undefined reference to `beginSerial'... i would really like some help on this pleas

oomlout says: Jun 10, 2009. 2:58 AM **REPLY**

Hi zeus (and fred) Sorry not to get back sooner. The problem has arisen from an update in the Arduino IDE. There is a conflict between the Serial library and another library we are using. To fix it simply remove all references to the Serial library and the include at the top. Or the easy option is we have changed the code on this page. Copy and paste the updated code (above) into an empty sketch and it should compile. Sorry about the error. Regards Stuart

fred_thedog says: Jun 8, 2009. 4:24 PM **REPLY**
I get the same error as TXTCLA55. Haven't spent any time trying to find the problem yet though.

ZeusFury says: May 30, 2009. 9:17 PM **REPLY**
avrdude: stk500_getsync(): not in sync: resp=0x00
avrdude: stk500_disable(): protocol error, expect=0x14, resp=0x51

i got these errors can some 1 help

evmaster297 says: May 23, 2009. 8:37 PM **REPLY**
with a wire less nun chuck, it looks like an awesome coaster to me!!! but eventually a dog toy

TXTCLA55 says: May 9, 2009. 10:43 AM **REPLY**
Errpr code: arduino cannot determine program size, says it cannot find the files needed

oomlout says: May 9, 2009. 12:22 PM **REPLY**
Hi TXTCL55; Sorry to hear about the error code, its never fun when something doesn't work. Something to try, is rather than downloading the files, copy and paste the code from this page into the Arduino IDE and see if it compiles. Sometimes this works (also "cannot determine program size" is sometimes only a warning and you may be able to upload after receiving it) Hope that was helpful, shoot us an e-mail at help@oomlout.com if that doesn't work and we'll try and get things sorted.

TXTCLA55 says: May 10, 2009. 6:15 PM **REPLY**
nope same error. I tried deleting the stuff at the end (labled "delete if not using") and I still got error codes. I'll try sending a email to the one you suggested.

Foaly7 says: May 8, 2009. 11:01 AM **REPLY**
Dude. Totally use a wireless WiiChuck and tweak its range and mount a camera on your 'bot and you can have a surveillance bot!

renamecor says: Feb 5, 2009. 1:09 AM **REPLY**
How cool is that, I'm off to see if I can find my daughters WREX and insert a wii nunchuck where the sun don't shine.

What about wireless nunchuck - WIreless Nunchuck

YummyPancakes says: Dec 26, 2008. 8:24 AM **REPLY**
Very, very cool! I just got a Wii for Christmas, and "Santa" accidentally brought us an extra Nunchuck and Wiimote. Together with my brand new Arduino Duemillanove, this is perfect! Thank you, and Merry Christmas!

ririgoyen says: Dec 17, 2008. 8:09 AM **REPLY**
you should look at Nyko's Kama (Wireless Nunchuck). You'll make your robot wireless in 4 seconds.

explosivemaker says: Dec 20, 2008. 2:12 PM **REPLY**
.....definitely.....a remote control car with a motion controller would be sweet....or a plane....

fwjs28 says: Dec 19, 2008. 12:20 PM **REPLY**
ha!nice mug...lol... here my version.... 1take wii mote and robot 2 tie wii mote to robot 3 drag wii mote and make robot move.....

cantthinkof bettername says: Dec 19, 2008. 6:47 PM **REPLY**
I just posted a comment almost the same, because I didn't read the comments first.

fwjs28 says: Dec 20, 2008. 5:53 AM **REPLY**
ha..yea i see that....i like the mug its hilarious...

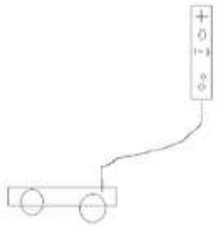
cantthinkof bettername says: Dec 19, 2008. 6:49 PM **REPLY**
My method (and fwjs28's) was the first thing I thought of when I posted the first comment, even before I clicked the instructable.

wolf555hound says: Dec 19, 2008. 5:26 PM **REPLY**
OMG, you stole MY method!!! hehe

fwjs28 says: Dec 19, 2008. 5:30 PM **REPLY**
um.....nu-uh.....its mine, allllll mine....lol....but my method also works.....just not as accurate maybe.....

wolf555hound says: Dec 19, 2008. 7:24 PM **REPLY**
no! see!

Wii Remote Robot



cantthinkof bettername says: Dec 19, 2008. 6:46 PM **REPLY**
I know how to do it with just the nunchuck and the robot. Step 1: Tie the wire to the robot. Step 2: Have fun!

mithunashok says: Dec 19, 2008. 6:12 PM **REPLY**
Mann...that was cool....