The Most Useless Machine EVER!

by SaskView on December 27, 2009

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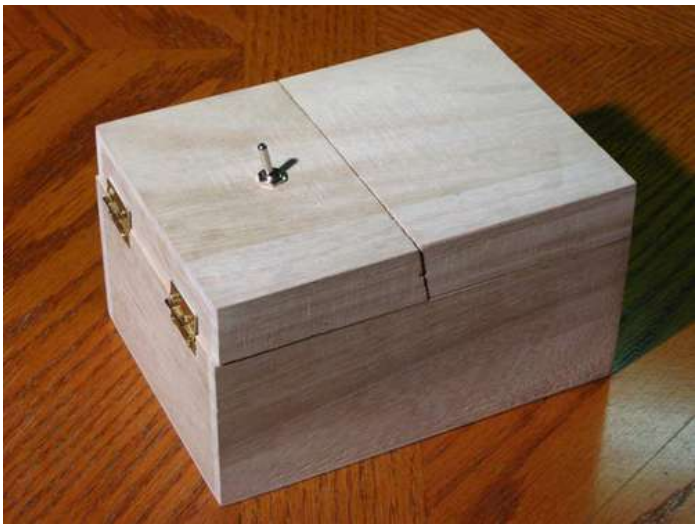
Intro: The Most Useless Machine EVER!

And yet everyone wants one!!!?

Update 1/1/2010: Happy New Year and all the best to you and yours!



step 1: Background

After seeing a video of such a machine I just had to have one of my own.

According to Wikipedia, Claude E. Shannon built the first “Ultimate Machine” based on an idea by Marvin Minsky.

The only design I could find uses a microcontroller but I consider this to be overkill (not knowing how to write code for micros may have had some influence on my humble opinion...).

Additionally, the microcontroller version really doesn't shut itself off. It's circuit remains powered even when the switch is in the off position.

Knowing a little bit about servos and basic electronics, I felt sure that I could build the machine using a simple analog circuit. My main goal however was to have the machine REALLY turn itself off.

The machine in THIS instructable accomplishes that!

step 2: How Does It Work?

Inside the box is a very simple circuit controlling a standard RC servo. It's powered by four double A batteries. When idle, the circuitry is fully powered down. Inside the box is a secondary power switch that is held in the off position by the servo arm.

The main switch (the switch on top of the box) is a Dual Pole, Dual Throw (DPDT) toggle switch. This type of switch is actually a pair of switches which operate together (Dual Pole) and both are On-On (Dual Throw).

One pole of the switch supplies power to the circuit. The other pole switches the servo arm back and forth.

When the toggle switch is turned on, it provides power to the circuit (using one pole of the switch) and sets the servo arm to rotate towards turning the toggle switch off (using the other pole of the switch).

As the servo arm moves away from it's off position it allows the secondary power switch to turn on supplying redundant power to the circuit.

When the servo arm reaches the toggle switch and turns it off, power is still supplied by the secondary switch. At this point the circuit now signals the servo to return to it's 'OFF' position.

The servo arm reverses direction returning to it's 'OFF' position and switches off the secondary power.

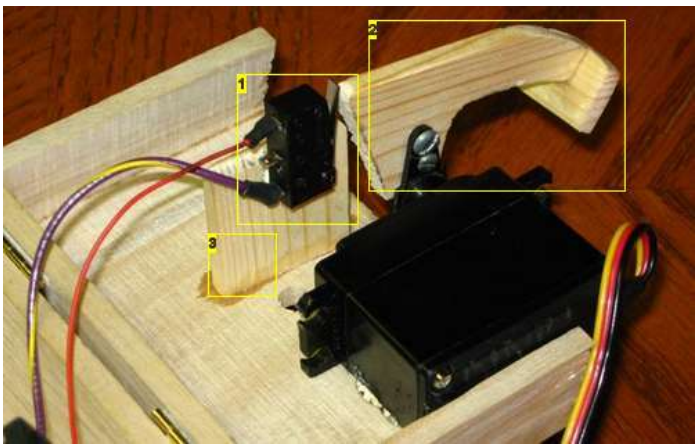


Image Notes
1. Micro switch supplying secondary power.
2. Pusher attached to servo arm with a couple of screws. In this photo the servo is in the 'OFF' position and is holding the micro switch off.
3. Wood 'standoff' for microswitch

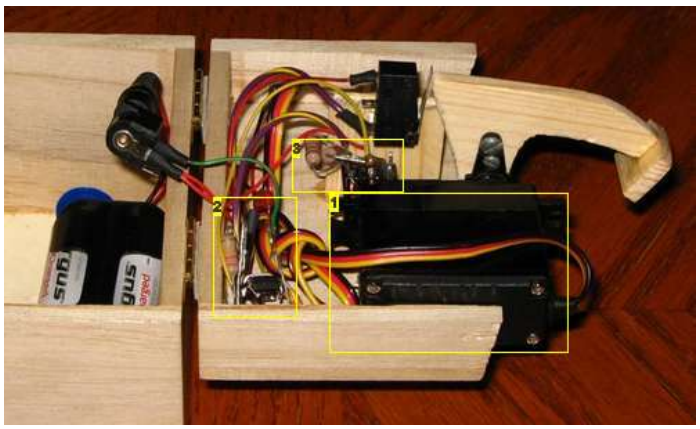
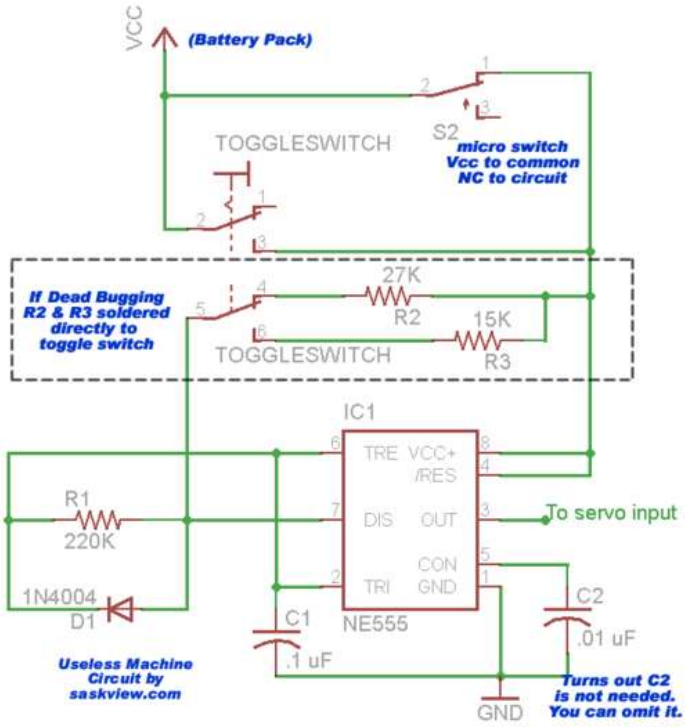


Image Notes
1. Servo
2. 555 timer circuit.
3. toggle switch with R2 and R3.

step 3: Schematic



step 4: Dead Bug Circuit Construction:

The circuit has very few parts so instead of making a circuit board or using a prototyping board I just soldered most of the components directly to the 555 chip.

This method of prototyping is called Dead Bug construction. As the name implies, the finished results aren't very pretty and often resemble a dead bug.

You'll need a fine tipped soldering iron, steady hands and basic soldering skills.

Keep in mind that you don't have to dead bug the circuit. I tested this circuit using a small breadboard that fit in the box with room to spare.

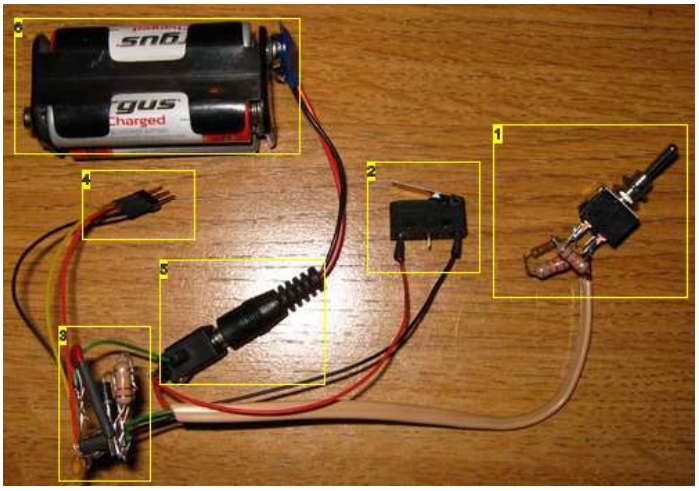
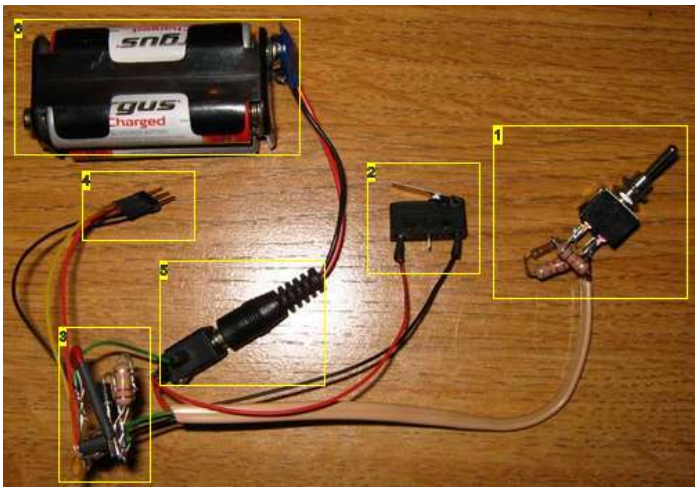


Image Notes
1. Toggle switch with R2, and R3.
2. Secondary power switch The battery (Vcc) is connected to the common pin (C) and the normally closed pin (NC) going to pins 4 and 8 on the 555 timer IC.
3. 555 timer chip with R1, Diode, and caps. Know as Dead Bug protyping.
4. servo connector
5. I added a connector for the battery pack
6. Battery holder for 4 double A batteries.



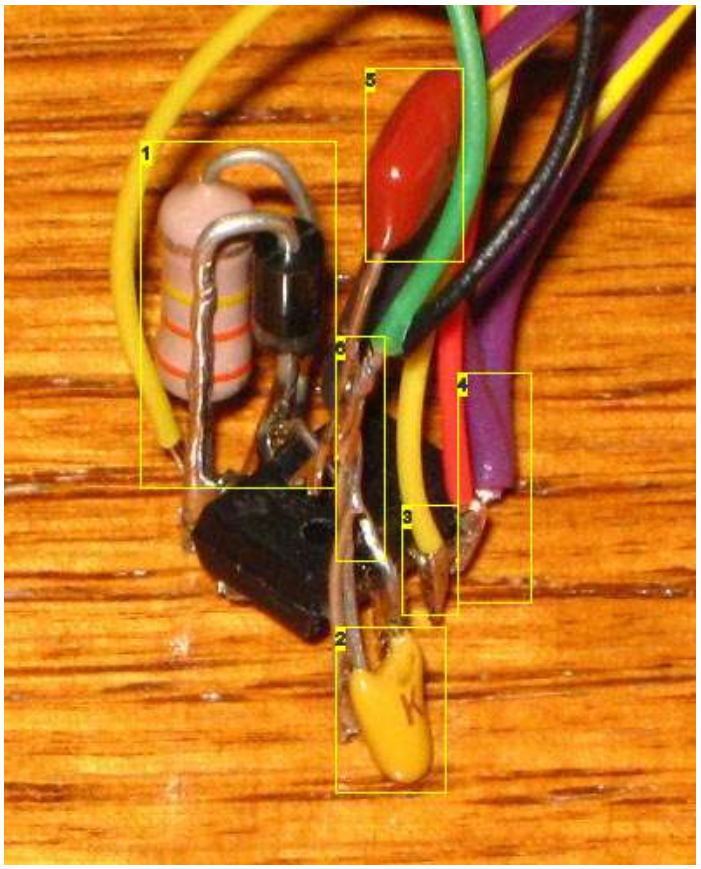


Image Notes
1. R1 and the Diode across pins 6 and 7. Also connected to pin 7 is a wire leading to the common of the toggle switch.
2. C1 across pins 1 and 2
3. wire connected to pin 3 leading to servo input
4. Purple wires are the switched power connected to pin 4. Pin 8 is connected to pin 4 underneath the IC but you can see it in the photo. The red wire is supplying power to the servo.
5. C2 connecting pin 5 to pin 1.
6. Grounds connected to pin 1 go to battery and servo.

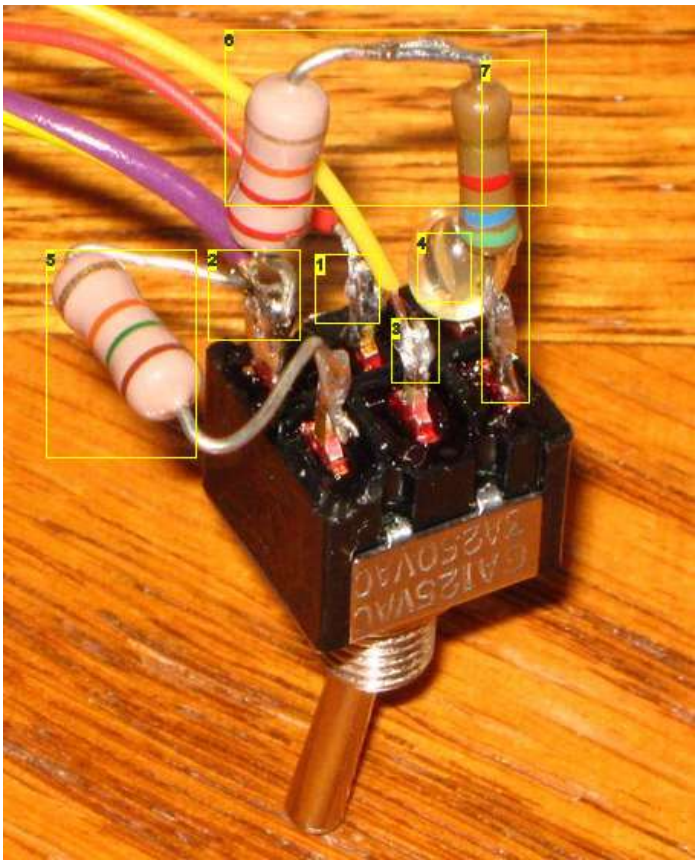


Image Notes
1. Vcc (Red wire connected to the positive of the battery pack) connected to the common of one pole of the toggle switch.
2. Purple wire supplying power to circuit . Connected to the 555 (pins 4 and 8) Also connected to this pin of the toggle are the resistors.
3. Yellow wire going to pin 7 of the 555 chip is connected to the common of one of the poles of the toggle switch.
4. This pin isn't being used so I put a blob of glue on for insulation.
5. R3: 15K resistor.
6. R2 The circuit calls for a single 27K resistor but I didn't have that value on hand so I used a 22K and a 5.6K in series. Also this is a great example of bad soldering technique. I should touch that one up instead I'll wait till I have the proper value R...
7. R2 connected bottom right pin of toggle

step 5: The Box

I don't have much skill in wood working so I was fortunate to find a ready made box at the Dollar store.

The box you use need only be big enough to fit a battery pack and servo. The one I used was about 5x4x3 inches.

I removed the latch that came with it. The lid was carefully cut down the middle and the hinges were move from the back to the side. A hole for the toggle switch was drilled in the other part of the lid about an inch from the cut side.

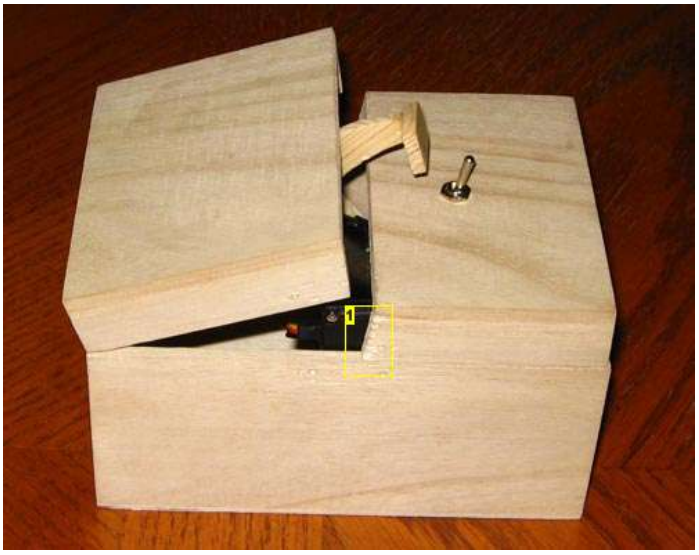


Image Notes
1. Cut at a sleight angle so the lid wouldn't bind when opening.

step 6: Parts

Hinged wooden box

analog RC servo (standard size)
AA 4 cell battery holder
555 timer IC
S1 DPDT Toggle switch
S2 Three terminal micro switch
R1 220K 1/4 watt resistor
R2 27K 1/4 watt resistor
R3 15K 1/4 watt resistor
C1 .1 uF capacitor
C2 .01 uF capacitor (I've since discovered C2 isn't required, you can omit it)
D1 1N4004 diode (just about any switching or rectifier diode should work)

Cost: around $25.00

When I built the machine, I had all the parts on hand, but they came from several sources.

I'm hoping to come up with a supplier that stocks ALL the parts. Problem I'm running into is being reasonably certain that they will work together.

It's important that the toggle switch doesn't need a lot of force to flip it. I'm using one made by Mode Electronics model no. 41-273-1

The servo I'm using is a very old Hitec HS-300. Not sure if they are still being sold. It's a standard size servo with a torque of 42.0 oz-in (3.02 kg-cm).

I would appreciate it if anyone who's built the machine could let me know what servo and toggle they are using, and where you ordered them from.

mrrigsby reports that a toggle switch from Radio Shack, catalog # 275-636 works.

He also pointed out that it's better to use "4 fresh alkaline batteries--with 4 rechargeables, I couldn't depend on having enough power to always throw the switch."

Related Instructables

Simple Servo Tester by nmcclana

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Comments

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tww1fa says: Jan 5, 2010. 11:08 PM REPLY

If I understand the schematic correctly, R2 and R3 are switched to determine the width of the pulses sent to the servo for the two end positions, right? So wide pulses are sent when the toggle is "on", and narrow ones are sent when it's "off" and the servo races to each end position.

I wonder if it would be possible to put in a simple RC circuit controlled by the toggle that would slowly widen and then slowly narrow the pulses so that the arm doesn't move at the full speed of the servo, but slower (maybe even make the arm extend slowly and retract as fast as possible.) Unfortunately my knowledge of electronics is still in the larval phase...

I might cheat and use an ATTiny13 instead of the 555... it should be pretty easy to write a simple varying PWM program, and no resistors/capacitors needed - just connect power and switches and servo.

SaskView says: Jan 6, 2010. 5:27 PM REPLY

You've got it.

I wanted to do just that, but I couldn't figure any simple way of doing it using analog circuitry.

You really should make a microcontroller version and post an instructable. My knowledge of coding for micros is not even at the larval stage. You could add a lot more personality to the machine this way.

tww1fa says: Jan 6, 2010. 8:38 PM REPLY

That's my plan. I should be able to get some simple code done in the next week or two. I want to make the movement give feeling of being exasperated at the person who turned it on.

livesteamfan says: Jan 6, 2010. 7:44 PM REPLY

Couldn't you just have it that when you turn the switch on, the arm comes up (also turning on the one in the box) and turns the switch "off" reversing the polarity on the motor and turning off the switch inside to cut power instead of using this circuitry?

dino8623 says: Jan 6, 2010. 6:19 PM REPLY

where can u buy S1 DPDT Toggle switch

fordman15243 says: Jan 6, 2010. 5:44 PM REPLY

(Sorry, another stupid question coming...) Can you tell me where the black wire for the servo goes to on the 555? I can't see on the picture...

dmheiland says: Jan 5, 2010. 9:02 AM REPLY

Hi there,

Knowing virtually nothing about electronics whatsoever, I'm starting out by trying to build this.

I'm in the UK, will any of the components change significantly?

I can't see an obvious replacement for the HS-300 - could someone link one?

Thanks

chubb667 says: Jan 5, 2010. 1:35 PM REPLY

if you log onto maplin.co.uk and serach for servo, any of those motors will do...

http://maplin.co.uk/Module.aspx?ModuleNo=3739

would work and is only £10

dmheiland says: Jan 6, 2010. 2:10 AM REPLY

Would this one work?

http://maplin.co.uk/Module.aspx?moduleno=9944

SaskView says: Jan 6, 2010. 5:15 PM **REPLY**

It should

Betsy69 says: Jan 6, 2010. 11:22 AM **REPLY**

I'm still taking it slow

www.flickr.com/photos/bas-marie/sets/72157622995805469/

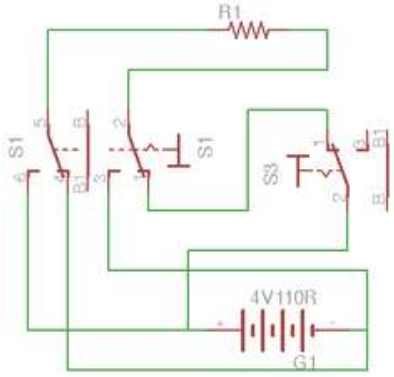
SaskView says: Jan 6, 2010. 5:14 PM **REPLY**

It's coming along GREAT!

compukidmike says: Jan 5, 2010. 8:43 AM **REPLY**

Great instructable! I just built one for myself yesterday! I would like to point out for those of you who don't want to build the electronics portion or don't have the parts, it can be completely eliminated. I modified the servo for continuous rotation (by removing the internal stop) and then soldered the red and black wires directly to the motor inside the servo, bypassing the electronics inside. Now it's just a motor with a gearbox. This allows you to use just the two switches to make the motor change direction and stop. I attached a schematic of how I hooked it up(the resistor represents the motor).

Overall, great instructable! And thanks for the idea!



DieCastoms says: Jan 6, 2010. 12:10 PM **REPLY**

Mike,

As I was reading through some of the replies, I got an idea of making this machine a little more interesting and intricate. Without saying exactly what it was I wanted to do, I was trying to figure out how I could control more than one servo off the 555 and creative wiring.. Your post answers the question.. Eliminate the 555... NOW the wheels are REALLY turning and my idea is .... unfortunately getting larger by the second! ;)

Here is another suggestion.. There are lot's of hobby gearboxes on the market. I'm sorry I do not know enough to suggest one, but might there be something more compact than a servo or something more powerful at less cost than a servo, which wouldn't have to be driven with the 555 or modified for continuous rotation?

Sask,

Awesome. Lovin' it. I laughed hard at the very last switch ont he video and your choice of music and video editing. Well done and a wonderfully 'cute' device! If you contact me directly, I will tell you my idea, I don't want it stolen before I get a chance to do something with it :P

~DieCastoms

P.S., For the person who asked, signing your comment yourself is just a simple sign of respect. When you mail a business letter, your name and usually your address are at the top, yet you always sign the bottom ...

SaskView says: Jan 6, 2010. 4:48 PM **REPLY**

Thanks!

No need to let the cat out of the bag. When it's ready make an 'ible and let me know.

compukidmike says: Jan 6, 2010. 1:17 PM **REPLY**

I too thought about a different gearbox, but since I had some servos on hand, I went with that route (I'm one of those people that have to build it in a day or it's never going to get done). As for finding a gearbox that is smaller, stronger, and cheaper than a servo, it will most likely come down to choosing two of the three. I prefer servos because they are cheap ($10-15), good amount of torque for the size, and the fact that you can put many different arms on them to suit your purpose. The main problem I've always had with gearboxes is how to connect them to your project easily. Well that's just my opinion. Good luck with whatever it is you're building!
-Compukidmike

dmheiland says: Jan 6, 2010. 2:13 AM **REPLY**

Have you thought about adding your own section to this thread? e.g. what parts you need for your version? What servo do you use and could all servos be modified in such a way? If so, how?

I'd be very interesting in building your version..

compukidmike says: Jan 6, 2010. 9:35 AM **REPLY**

I'm new to the instructables thing, so I don't know how to add my own section, but I'd be glad to if you could tell me how.

The parts needed for my version are as follows...
DPDT Toggle switch (same as original)
SPDT Micro switch (same as original)
Standard servo (same as original)
4AA battery pack (same as original)

These are the parts needed for my version. As you can see, it's the same parts as the original, minus the electronic bits. As for the servo, any standard servo can be modified this way. There are many websites showing how to modify a servo for continuous rotation. Here's an instructable (http://www.instructables.com/id/Modify_a_Futaba_S3001_servo_for_continuous_rotatio/). Where most instructions end on modifying the servo, I added one step. Move the red and black wires from the circuit board directly to the motor contacts (the circuit board can be left in place). Doing this allows you to just power the motor and not worry about complicated servo control pulses. All you have to do then is connect the red and black wires in place of the resistor in my schematic above.

If you have any further questions, just ask!

SaskView says: Jan 6, 2010. 5:12 PM **REPLY**

Well done! My main goal was for the machine to be easy to build, and your idea is great.

dmheiland says: Jan 5, 2010. 10:00 AM **REPLY**

Does this mean the unit is always 'on' and running (therefore using power)?

compukidmike says: Jan 5, 2010. 11:01 AM **REPLY**

not at all. It is completely off until you flip the switch.

When you flip the switch on top, it hooks the battery to the servo, then when the arm flips the switch the other way, the polarity of the battery to the servo is reversed, causing the arm to retract. When it hits the internal switch, the battery is completely disconnected, so no power is used when it's off.

big-jamie says: Jan 3, 2010. 7:21 AM **REPLY**

think you could possibly make one that, a small arm comes up to turn it on, then another arm turns it off, which in turn...turns it back on, and so forth lol, i think that would be pretty funny to see =)

dagenius says: Jan 3, 2010. 11:17 AM **REPLY**

how would it turn back on with no power after it turned itself off?

big-jamie says: Jan 5, 2010. 11:45 AM **REPLY**

well i dont really mean turn off, i mean like, turn it on (using a separate switch) and an arm pops up, to turn the other arm on, which when it pops up turns itself off....and the other back on, which then turns itself off....and the other on

know what i mean ? like it never ends =)

ganey says: Jan 6, 2010. 1:51 PM **REPLY**

So if you had a box with two flaps, one switching it one way, the other switching it another way?

fordman15243 says: Jan 6, 2010. 2:26 PM **REPLY**

would it be possible to make two of the circuits mentioned above but use one switch and when one turns itself off it turn the other on...? just wondering... =P

mrigsby says: Jan 3, 2010. 12:18 PM **REPLY**

I had to build one of these and the video shows it in operation. I had to cut the resistor values to about 3K and 1.5K and I had to fiddle with the arm construction and switch mounting--but IT WORKS! I suspect most people will want one when they see it. Good job!

SaskView says: Jan 3, 2010. 12:29 PM **REPLY**

Very cool. Are you using 1 microfarad for C1?

Can you let us know the make and model of toggle switch you use so I can add it to the parts list?

mrigsby says: Jan 3, 2010. 1:25 PM **REPLY**

Yes--I used 1 microfarad for C1 (I misread your diagram, with .1 everything would work as you described). For a toggle switch, I used one from Radio Shack, catalog # 275-636.

I used 4 fresh alkaline batteries--with 4 rechargeables, I couldn't depend on having enough power to always throw the switch.

SaskView says: Jan 3, 2010. 4:30 PM **REPLY**

The original schematic I uploaded was to blame, my apologies.

Good tip about the batteries. Alkalines have a slightly higher voltage than rechargeables, and this will give your servo more torque.

And thanks for the toggle part no.

ticoun says: Jan 4, 2010. 8:22 AM **REPLY**

for mine (under construction) im using a rechargeable Ni-Cad 9v battery and all goes well since that old battery gives me 9.6v.(note that im using a 9v motor instead of an expensive servo)
i will post a video of my work when it will be done.

and thanks for the idea and instructions

DieCastoms says: Jan 6, 2010. 12:17 PM **REPLY**

Ticoun,

Please do post pictures of your construction, as I was wondering about using a motorized gearbox instead of a servo. Tell us where your motor is from please?

Also,
WHY IS THIS THING SO D**M AMUSING! It has no right to be!!
But it makes me giggle every time! :D

~DieCastoms

Fishpail says: Jan 5, 2010. 7:07 PM **REPLY**

Maybe I'm too simple and I would enjoy a single button that just makes a sound, i say it's more useless than this sweet machine.

adamvan2000 says: Jan 5, 2010. 2:20 PM **REPLY**

I'm picturing one of these combined with other useless machines that have a rube goldberg type effect before finally turning off the switch again. It would take a lot of thought, as the machine would also have to turn all it's components off, too.

~adamvan2000

Fishpail says: Jan 5, 2010. 7:05 PM **REPLY**

It would be more awesome if the whole system resets, and not just the switch. Then again this idea wouldn't be useless, it would invoke discussions about thermodynamics :D

PS: you don't need to sign your own comments, your username shows up automatically, and if you knew that already, kindly let me know why you did that anyway.

judobrian says: Jan 5, 2010. 12:46 PM **REPLY**

Thanks for the info. One last question. Is one of the resistors responsible for controlling the speed of the servo arm? I saw this one: http://www.youtube.com/watch?v=2F_BKe-XWo4&feature=player_embedded and it moves VERY fast. I think I'd like to have something moving a little fast than the SaskView's machine, but slower than the link shown above.

Almost have all my parts, can't wait to get going!

desertdog says: Jan 5, 2010. 9:25 AM **REPLY**

How cool. Maybe useless but very cool.

CORNSTALK says: Jan 3, 2010. 11:03 AM **REPLY**

Nice job on the machine...love it!

I've been looking at servos. There are so many to choose from the "standard" servos, some with metal gears, plastic gears, hi-torque, etc etc.
I measured the torque required to operate a small DPDT switch and that was ~350g, apparently much more than the servos I've seen.

Can you be more specific, like model number, where you purchased it, etc.?

Thanks!
Missouri Ham

SaskView says: Jan 3, 2010. 12:03 PM **REPLY**

This is a valid point: the toggle switch has to be one that doesn't need a lot of force to flip it.

The toggle switch I'm using is made by Mode Electronics model no. 41-273-1

The servo I'm using is a very old Hitec HS-300. Not sure if they are still being sold. It's a standard size servo with a torque is 42.0 oz-in (3.02 kg-cm).

Problem I'm running into is finding a supplier with ALL the parts and to be reasonably certain that they will work together.

I would appreciate it if anyone who's built the machine could let me know what servo and toggle they are using, and where they are available so that I can add this to the parts list.

CORNSTALK says: Jan 3, 2010. 2:22 PM **REPLY**

Thanks SaskView! Having the data for the servo helps a lot. Now it's just a matter of locating one with similar specs.

I think just about any minature toggle switch like you used will work just fine. BTW, in case anybody is wondering how I measured the operating force for my switch, I used a digital postal scale and slowly put pressure on the switch handle until it operate....took measurements several times to get a good average.

compukidmike says: Jan 5, 2010. 8:50 AM **REPLY**

keep in mind that the servo arm will be moving when it hits the switch, having some inertia behind it. I think you'd be surprised at the amount of torque a servo can provide. I built one using a cheap servo that is almost 15yrs old, and it works great. Just my 2cents. Good luck with your build!

RAM says: Jan 5, 2010. 8:28 AM **REPLY**

Fantastic and simple!
The box could be colored green and themed - "Dont Forget to put off the switches when not in use" - conveys a strong message too!

thanks!

catdadt says: Jan 5, 2010. 7:56 AM **REPLY**

Aw man that was cool, soon as it warms up I'm going to the shed and clean my work bench off and get started on one.

russm313 says: Jan 5, 2010. 6:55 AM **REPLY**

This is fantastic! I love gadgets like this for my desk. I have made the electronic dice, and they are a big hit. I can't wait to make this! Maybe this weekend....

Incanus says: Jan 5, 2010. 5:30 AM **REPLY**

It should be possible to ultra simplify this using just one switch and a wiper motor as the auto-parking mechanism in a wiper motor does the job of the 555 and extra switch.

Tinker83 says: Jan 5, 2010. 4:41 AM **REPLY**

ok, thats just way too funny...

ppol says: Jan 4, 2010. 11:30 PM **REPLY**

this is great i love it 5*s

kaptaink_cg says: Jan 4, 2010. 9:12 PM **REPLY**

Before I watched the video, I wondered how a "useless box" could have such a high rating... LOL!
I'm DEFINITELY making one of these!!!!! 5 stars!

(damn.. I have too many projects in the works already..)

tremmert says: Jan 4, 2010. 7:24 PM **REPLY**

Great project! I am new in electronics, and am attempting to build this machine. I have all the parts, and it has been breadboarded. But when I supply power, I just get one little tick out of the servo everytime I press the rocker switch. I keep checking the wiring and it looks correct. I am not sure about the toggle switch wiring though. Having trouble figuring out the schematics. Has anyone else redone the schematics?

SaskView says: Jan 4, 2010. 8:37 PM **REPLY**

Most likely means the 555 timer isn't working. The close up of the toggle switch in step 4 has some image notes on wiring that might help.

view all 240 comments