Control Your World
and
Build a Better Mouse Trap

By Michael Simpson

I moved out of the city years ago and now live in the country in an old farm house. We have three barns and suffer quite a bit of damage from the local mouse population. I have used several types of traps with varying amounts of success. Being the provincial inventor, I decided to design my own mouse trap.

I decided on the following requirements

- The trap must capture the mouse unharmed.
- The trap must run on 4 AA rechargeable batteries.
- The trap must run for at least one month before the batteries must be charged.
- The trap must sound an alarm once a mouse has been caught.
- The trap must work in any kind of lighting conditions.
- The trap must hold the mouse until it can be released into a safe location.

I wanted to build something that could be easily duplicated with readily available parts so that others could build the same or similar trap. In this article I will show you two variations of the mouse trap. The first uses a PC to monitor the trap and to sound an alarm. The second is totally self contained.

Mechanics

For both traps the mechanics are the same. Several ideas came to mind such as trap doors, swinging doors, and sliding doors. I decided on a dropped door. With this type,

you have a heavy door which slides in a groove. The door is suspended by a pull pin that when pulled allows the door to fall, blocking the opening.

The actual door is made out of a steel truss plate that measures 5-3/4" x 7". You can pick these up at any home center. The particular one I am using is a Simpson TP57.

You will need to create a grove in a couple pieces of wood to act as a track to hold the door in place. This can be done with a table saw or by sandwiching and gluing up a few pieces of wood.

If you are still having trouble picturing what I am trying to describe, think of a guillotine but not quite so deadly. Figure 2 shows one of the guides I built.

Figure 2

Next you will need some sort of mechanism to hold the door in place until it is tripped.

Figure 3

Figure 3 shows a small pull pin that I created that holds the door in place until the pin is pulled. The pin is a piece of thin brass tubing about 3/32" in diameter. The pin must be able to slide through one of the holes in the truss plate as shown in Figure 3.

The pin is attached to the end of a piece of nylon string (Fishing Line). Knot the end of the line and pull it through the tubing. A small drop of hot glue will help secure it.

Originally I thought about some sort of light and sensor, but I wanted something a bit more passive that would not place any additional drain on the battery. What I came up with was a balanced plate made out of the same Truss material as the door.

Figure 4

I soldered a 7/32" brass tube across the width of the truss as shown in Figure 4. The tubing is not exactly in the center, but about ¼" toward the back of the truss. When flipped over this creates a kind of shallow teeter-totter effect. The heavier side will face the trap opening. The idea is to place bait on the high end near the edge. When the mouse enters the trap he walks up the ramp and as he passes the pivot point the ramp tips.

Figure 5

A second brass tube is hot glued to the base of the trap near the rear. This tube sets under the high end of the teeter-totter so when the ramp tips it makes contact with this tube. Notice the wire that is soldered to the tube. This is connected to Vss side of the interface. The brass tube connected to the ramp is connected to the input port on the interface. The input port on our interface is held high. This tipping the ramp forces the input port low.

The rest of the trap is all a matter of taste and the materials you have on hand. Some key points for this kind of trap: make the trap enclosure so that it is only slightly larger than the width of your ramp as shown in Figure 6. This will keep the sneaky critters from bypassing the ramp. Remember the food itself has weight and should be used to help counter balance the trap. When I place my food on the high end of the ramp I start in the middle and slide it back until the ramp is almost ready to trip. This allows you to adjust the sensitivity of the trap.

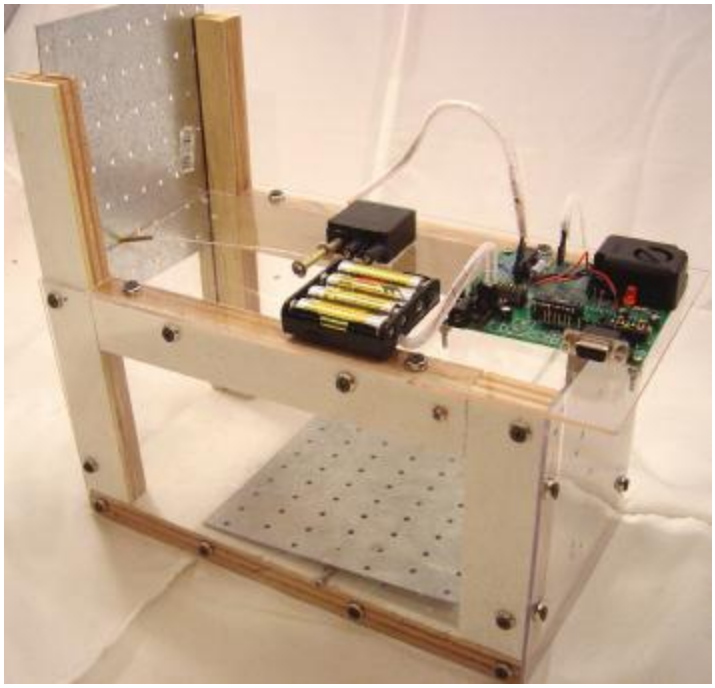


Figure 6

I used 1/8” Plexiglas and plywood for my trap. Strips of precut pine would also work. It is all held together with screws. I have found that the use of transparent materials makes the trap more inviting to the mice. They probably think they have an easy escape.

Servos

In order to trip the trap we need to pull the pin out of the door causing it to fall. There are a couple ways you can use a servo to pull the pin. Let’s take look at both a Vex servo and a normal servo.

Vex Servo

The fishing line I used was about 4-1/2” long with the pull pin on one end and the other end connected to a brass tube that is attached to a VEX servo via a #6 machine screw as shown in Figure 7.

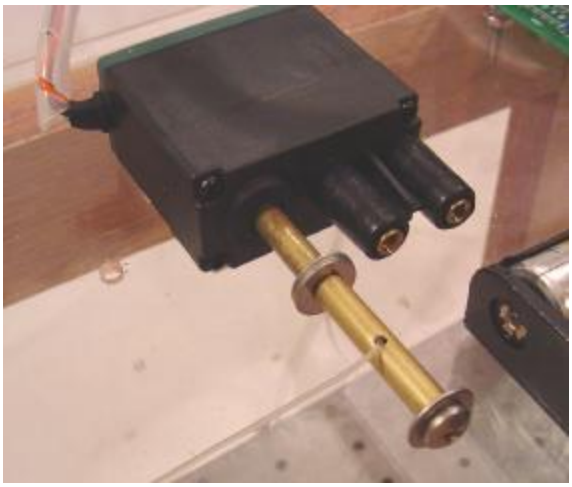


Figure 7

My servo implementation was a bit over kill as the servo only needs to pull the pin about ¼” of an inch. You could have just knotted the end and placed it between a couple of washers to work. To properly place the servo, raise the door and put the pull pin in place. While holding the pin in place move the servo back until the line is taunt. The pull pin should be sticking through the door about 1/16” or so. I used double sided tape to hold my servo in place.

Standard Servo

The standard servo is much easier to use than the Vex. You will need a servo arm. Just about any type will do. Cut all the points off the arm but one.

Figure 8

Place the arm near the center position of the servo as shown in Figure 9. Notice that we can use small angle brackets to mount the servo or double stick tape.

Figure 9

With the servo placed near the center position as shown in Figure 9 tie off the line. The pin end of the line should be sticking through one of the holes holding the door in place. Don't worry if you don't get it perfect as you can always go back and retie the line.

Electronics

As I mentioned earlier I am going to show you two different interface types.

SSC-32 Interface

I got my hands on a SSC-32 servo controller for another project I was working on. At $39.95 this is the best darn servo controller I have ever used. It has a built-in RS232 driver so it can be connected directly to the PC or controlled via a microcontroller.

Figure 10 Figure 11

What makes this servo controller so great is that it will control up to 32 servos via a very simple interface. You can set the time the servo takes to create its programmed move or even send commands so that groups of servos can be controlled all creating there movement over a predefined period of time. While we won't be using any of these advanced features in our mouse trap we will be accessing the one of the other cool features. The SSC-32 has 4 inputs that can be read independently of any of the servos.

I used the default power configuration on the SSC-32 which allows a single battery to supply power to the servos and the logic. LynxMotion also sells a small pre-wired power harness that has a power switch and RC stick battery connector as shown in Figure 11.

I'm not going to show a schematic for the SSC-32 interface as it is very simple.

- Apply Power Source to **VL** leads
- Plug servo into **Servo 0** position
- Connect Ramp leads to the **B and -** header
- Connect PC Serial to 9-pin connector.

Note that I used a 2000Mha stick battery but you can use the same 4 cell battery back that I used on the Athena interface and it will work as well. You will have to charge the batteries more often though.

To control the SSC-32 we will use Zeus. Zeus is a simple programming language that specializes in interface design. You can get a light version of the software from the krmicros website. Along with the source code I have included the compiled programs, so even if you are not the best programmer in the world you have lots of choices here.

To quickly test your mouse trap place the MouseTrap_DT.exe file along with the mouse.jpg and scream.wav and run the file.

If your PC is already connected to the SSC-32 and it is powered up the servo should arm. This means that it should be slightly forward. When the trap is tripped the servo arm will pull back then move back into the armed position.

Have fun and play around with the program. The source is called MouseTrap.txt.

Athena Stand Alone Interface

While the PC controlled trap is cool to play with and fun to test your trap it is not very practical in the long term for a few reasons.

- A 2000Mha battery powering the SSC-32 will only last a couple days.
- You need to tie up a PC or LapTop.
- You need to tether the MouseTrap to the PC

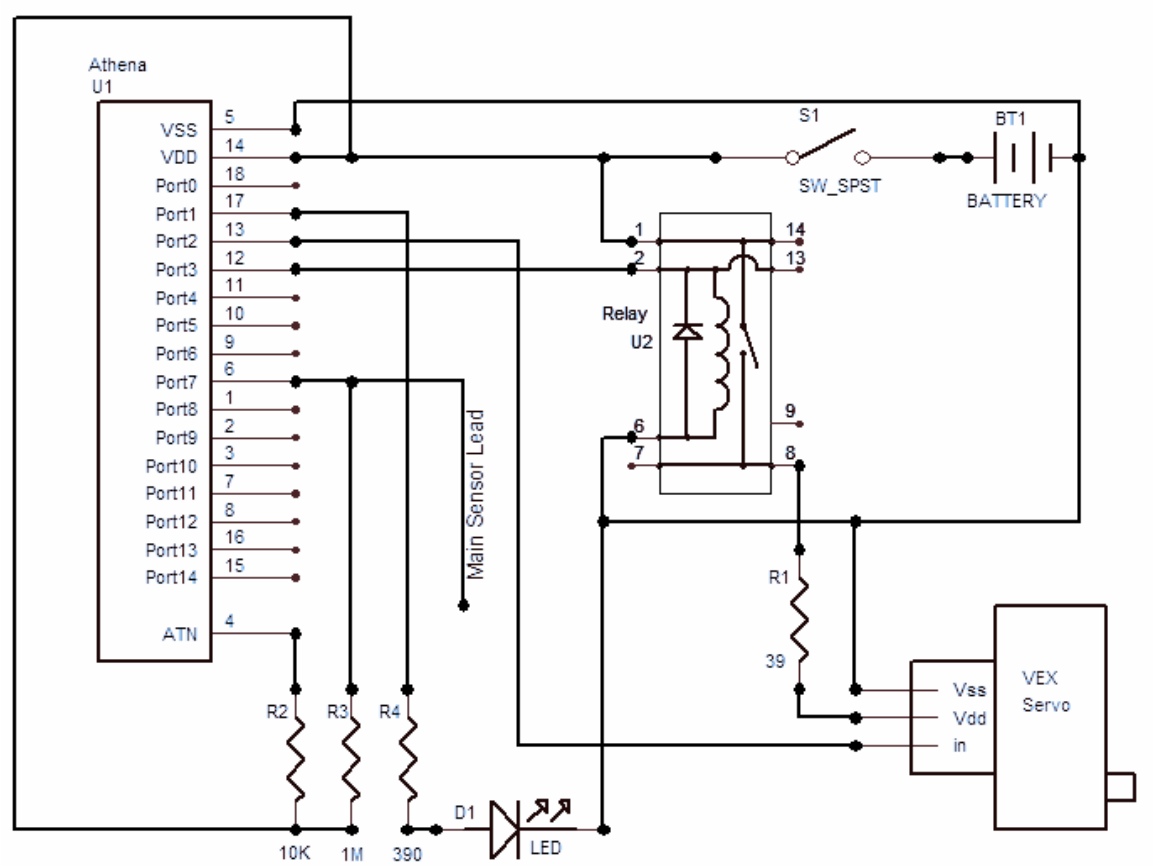
With this interface we will use a very inexpensive Athena microcontroller.

The Athena has a sleep state that uses very little power when configured properly. I built a light monitoring circuit that uses an Athena that has been running on a single set of alkaline batteries for over 2 years. The problem is the servo. Even with no signal being sent to the servo it still uses quite a bit of power. This drastically shortens the battery life, so I had to come up with some way to remove the power from the servo when it was not in use.

Kronos Robotics sells some relays that can be connected directly to a microcontroller. They have a built-in diode that protects the microcontroller from any EMF generated by the coil. They are in a 14 pin dip package so they work with a standard 14 pin dip socket.

I used one of these relays to remove the power from the servo when not actually moving the servo.

Schematic 1 shows the complete schematic that I used. If you want to add an alarm to the circuit simply place it across the power leads connected to the servo. That way when the relay turns on power to the servo it will also sound the alarm.



Schematic 1

There are several sirens you can use for the trap. The one I used has a sound level of 90-100db.

With the circuit shown in Schematic 1 you will get at least 1 month of continuous use with 1 set of rechargeable batteries. Something to keep in mind. While I have successfully used alkaline batteries they will deliver about 6v when new. This is .5v over the rated voltage of the Athena. While I have yet to blow an Athena this way it is not recommended. If you use rechargeable batteries you will get 4.8v to 5v from a freshly charged set.

Note that the schematic shows a Vex servo. You can use a standard servo as well.

R1 the 2 Ohm resistor connected between the servos Vdd and the relay. This will keep the servo from resetting the microcontroller when first fired.

Note that a .1uf and a 100uf capacitor should be connected to Vdd and Vss as close to the microcontroller as possible.

The SPST switch S1 is not necessary if you use a header and jumper to provide power to the circuit, as you can just remove the jumper when you want to disable the system,

I used an Athena WorkBoard PCB, as it provides ample prototype space to connect the Siren and relay. After I placed my servo, I attached the battery and circuit board to the top of the trap as shown in Figure 6.

If you use one of the Kronos Robotics Boards that have a built-in RS232 driver, remove it during normal operation. As it is not needed it will reduce battery drain.

Program

The program is strait forward. It sets up the IO ports then arms the servo by adding a slight amount of slack to the line.

The main loop puts the microcontroller to sleep. The short from Port 7 to Vss will wake up the microcontroller. Once awake, it activates the servo by pulling the pin then pauses a bit and rearms the servo. It does not really arm the servo since the pin is pulled, but it does arm the sensor. This allows the siren to keep sounding as the mouse moves up and down the ramp.

```
'AthenaMouseTrap Program

  dim x
  RCSTA=0
  configio 0,1,2,3,4,5,6,8,9,10,11,12,13,14
  Gosub ArmServo
  gosub blink
  p7irq 3

loop:
  sleep
  gosub ActivateServo
  longpause 250,8
  Gosub ArmServo
  Gosub blink
  goto loop

ActivateServo:
  high 1
  high 3

  for x = 0 to 20
     Servo 2,80
     pause 20
  next
  low 3
  return

ArmServo:
  high 3

  for x = 0 to 20
     Servo 2,200
     pause 20
```

```
  next
  low 3
  return

'Let us know its armed
blink:
  for x = 1 to 20
    high 1
    pause 2
    low 1
    pause 50
    next
```

The Athena source is called AthenaMouse.txt and is included in the download.

How well does it work?

In the first week I caught 12 mice. I have an enclosed patio and that seems the main mouse thoroughfare for most of the mice scoping out my house.

One of the barns on my property is a good distance away from the house. It is not used so it makes a good place to relocate the mice once I catch them.

Some experiments I plan are to tag the mice and let them go at various distances way from the house to see how many make it back.

Keep in mind when working with wild mice, you need to wash your hands after handling any thing that comes in contact with the mouse or feces.

If you must handle the mouse use gloves. Wild mice are no where as tame as the ones you see in the pet stores. They can also be quite crafty. Normally, the larger and older the mouse the craftier.

Bait

Here are a few suggestions on bait:

- Peanut butter
- Oats (Oat Meal)
- Chocolate
- Water
- Pretzel

Don’t use cheese as it dries out too fast. I use a combination of peanut butter with small chocolate gram cracker pieces and oats. Try other ingredients if the above does not work for you.

Be sure to visit the Kronos Robotics Web site for more information and updates.

Parts

Athena Microcontroller Kronos Robotics #16276
Athena WorkBoard PCB Kronos Robotics #16460
Athena WorkBoard Basic Kronos Robotics #16473

Note the following components can be picked up at any electronics supply house.

Relay Kronos Robotics #16461
LED Kronos Robotics #16234
4AA Battery Holder Kronos Robotics #16323
2 Ohm 3 Watt Resistor Kronos Robotics #16197
390 Ohm Resister Kronos Robotics #16190
10k Resistor Kronos Robotics #16193
1M Resistor Kronos Robotics #16196
.1uf Capacitor Kronos Robotics #16198
100uf Capacitor Kronos Robotics #16202
Siren Kronos Robotics #16329
The Athena compiler is available free at the Kronos Robotics website at www.kronosrobotics.com.

Standard Servo Tower Hobbies
www2.towerhobbies.com/cgi-bin/wti0001p?&I=LXUK84&P=ML

SSC-32 LynxMotion #SSC-32
Wire Harness LynxMotion #WH-01

Links

KronosRobotics	www.kronosrobotics.com
KrMicros	www.krmicros.com
LynxMotion	www.lynxmotion.com
Tower Hobbies	www.towerhobbies.com