ULTRASONIC MOTION DETECTOR

MUSIC BOX PROTOTYPE 3

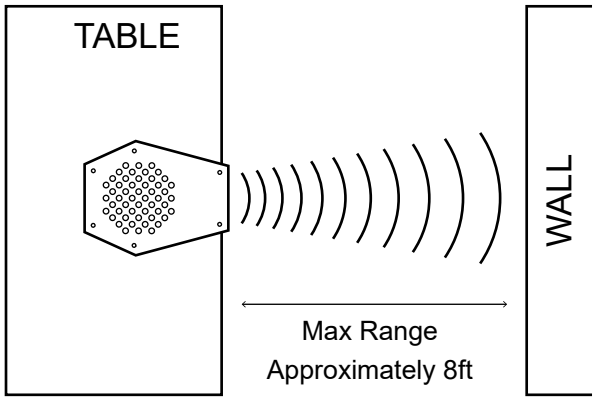
OPERATING INSTRUCTIONS

Ultrasonic Motion Detector intended for novelty use only. Does not detect ghosts, spirits, or non-corporeal entities of any form.

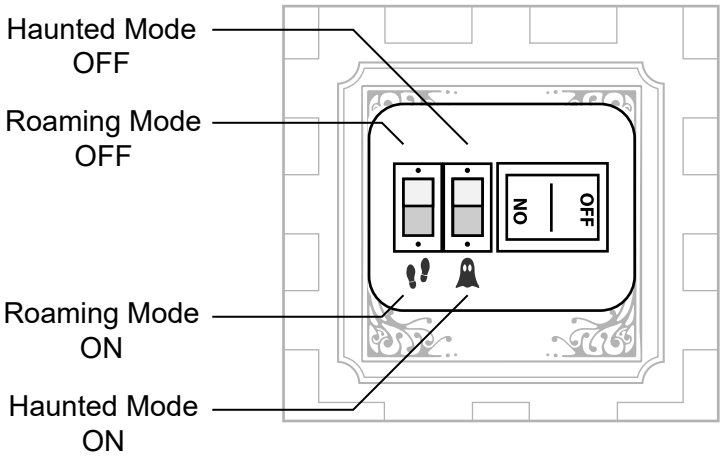
PATH MONITORING MODE

In Path Monitoring Mode the Music Box is triggered by movement within a 15-foot range in front of its sensors.

1. With the Music Box turned off place the Music Box on solid surface such as a counter or table. Point the sensor side of the music box so that it is either facing an open area, or so that it is faces a parallel, flat surface, such as a wall.
2. Set the “Roaming Mode” switch to the upward, OFF position.
3. Flip the large, black switch to the ON position.
4. The white LED will flash several times while the Music Box calibrates.
   DO NOT MOVE THE BOX WHILE IT IS CALIBRATING If needed the box can be reset and recalibrated by turning it off and back on again.
5. When the LED stopped flashing the Music Box is active and will detect movement that passes in front of it. DO NOT MOVE THE BOX! Moving the box at this point will cause false readings.
   If want to move the Music Box, or move it accidently, you can reset it by turning it off for a few seconds and then turning it back on.



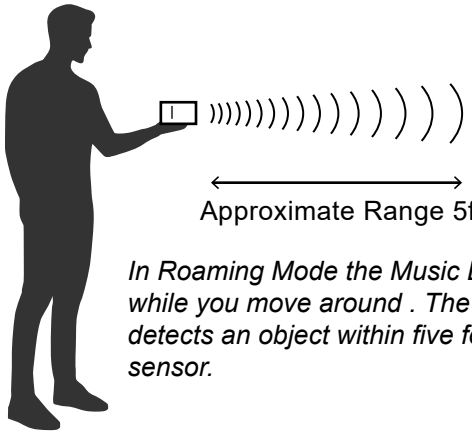
When using Path Monitoring Mode place the Music Box on a solid surface and either point its sensors toward an open area, or toward a parallel, flat surface such as a bare wall.



ROAMING MODE

In Roaming Mode the Music Box can be carried around and will be triggered by objects within its approximately five foot detection range. It will also be triggered if you move the sensor range into an object.

1. With the Music Box turned off set the “Roaming Mode” switch to the downward, ON position.
2. Hold the box in front of you with the sensor facing away.
3. Flip the large, black switch to the ON position.
4. The Roaming Mode is now active and you can walk around with the Music Box.

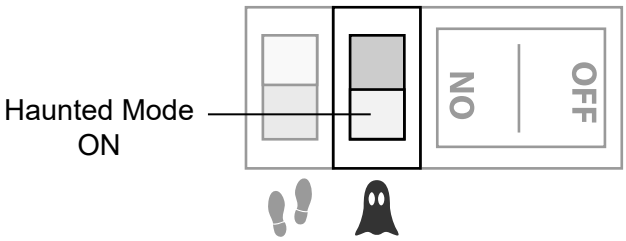


In Roaming Mode the Music Box can be held while you move around . The Box will trigger if it detects an object within five feet in front of its sensor.

HAUNTED MODE

In Haunted Mode, the Music Box will automatically activate at random intervals, approximately once every twenty minutes.

1. With the Music Box turned off set the Haunted Mode switch to the lower, ON position.
2. Flip the large, black switch to the ON position.
3. The Music Box will now operate as usual except that it will randomly trigger even if it does not detect an object.

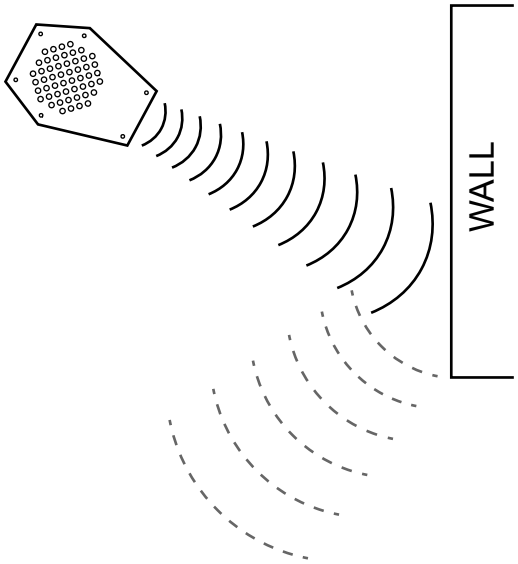


To enable Haunted mode set the Haunted Mode switch to the down position toward the ghost icon.

HOW ULTRASONIC SENSORS WORK

Ultrasonic sensors, such as the one used in this Music box, work by emitting a high frequency sound and then listening for the echo reflection of that sound. To measure distance the sensor compares the time passed between sending the sound and hearing it reflected. By calculating this measurement and the speed of sound, a distance can be estimated.

The Music Box constantly takes new distance readings to determine if there is an object in its detection range. In Path Monitoring mode the Box compares the new readings against those taken during calibration. If there is a difference between those two measurements the Music Box is triggered. In Roaming Mode the new readings are compared to a preset value of approximately five feet.

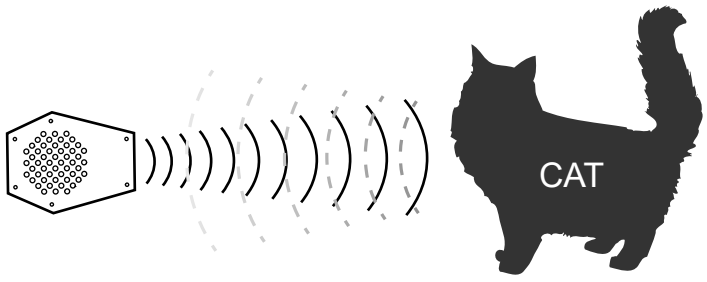


Ideally the Music Box's sensor should be pointed toward a flat, parallel surface. Angled surfaces can deflect sound waves away from the sensor.

LIMITATIONS OF ULTRASONIC SENSORS

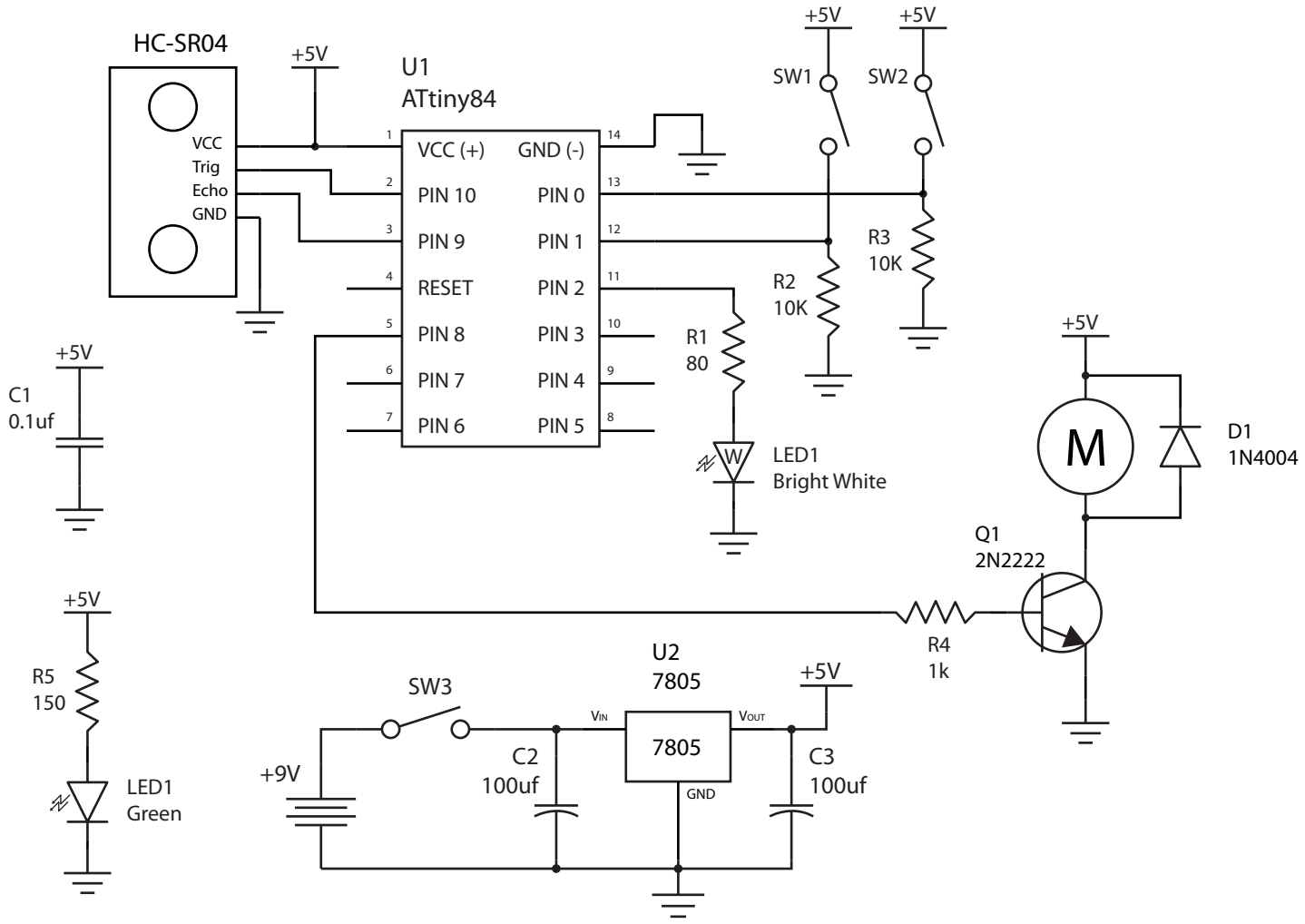
There are conditions which can cause ultrasonic sensors to provide inaccurate readings. These conditions include, but are not limited to the following:

- The sensor is facing an angled surface
- The sensor is facing a cluttered surface
- The sensor is facing a soft surface
- Dust particulate in the air
- Variations in air temperature
- Ambient sounds



Soft surfaces can dampen the reflected sound waves and cause inaccurate readings.

SCHEMATIC



ARDUINO CODE

Arduino code available at github.com/Tomdf/Ultrasonic-Motion-Detector-Music-Box

BILL OF MATERIALS

Label	Part	Qty	Price Each	Total
D1	Diode 1N4004	1	$0.30	$0.30
Q1	2N2222 Transistor	1	$0.19	$0.19
R1	80 Ω	1	$0.10	$0.10
R2-3	10k Ω	2	$0.10	$0.20
R4	1k Ω	1	$0.10	$0.10
R5	150 Ω	1	$0.10	$0.10
C1	0.1uf	1	$0.10	$0.10
C2	100uf	1	$0.20	$0.20
C3	100uf	1	$0.20	$0.20
U1	ATTiny84	1	$1.64	$1.64
U2	7805 5v Regulator	1	$0.45	$0.45
SW1-2	Switch SPDT	2	$0.48	$0.96
SW3	Switch SPDT On Off	1	$0.53	$0.53

LED1	10mm LED Bright White	1	$0.32	$0.32
LED2	5mm Green	1	$0.16	$0.16
	3D Printed Parts	1	$0.13	$0.13
	O-Ring 50mm 3mm	1	$0.30	$0.30
	Protoboard	1	$1.20	$1.20
	Wood Finish	1	$1.50	$1.50
	Acrylic Lid	1	$2.50	$2.50
	Battery Case	1	$2.50	$2.50
	HC-SR04 Ultrasonic Sensor	1	$3.00	$3.00
	Wood	1	$3.30	$3.30
	Music Box Mechanism	1	$3.33	$3.33
	Motor	1	$4.00	$4.00
			Total	$27.31