

Morris

Mobile Pet Feeder Sensor Development

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The core feature of Morris is the ability for him to find the target bowl to dispense food in. After some thinking, I figured the best approach to this would be to use a simple IR beacon / detector system. After deciding on the course of action, I then sat down to figure out how the system would be mounted on both the bowl and on Morris, and also how many detectors/emitters I should use to be the most effective. **Figure 1** is a sketch of the final realization I decided on which would hopefully yield the most effective solution to the problem at hand.

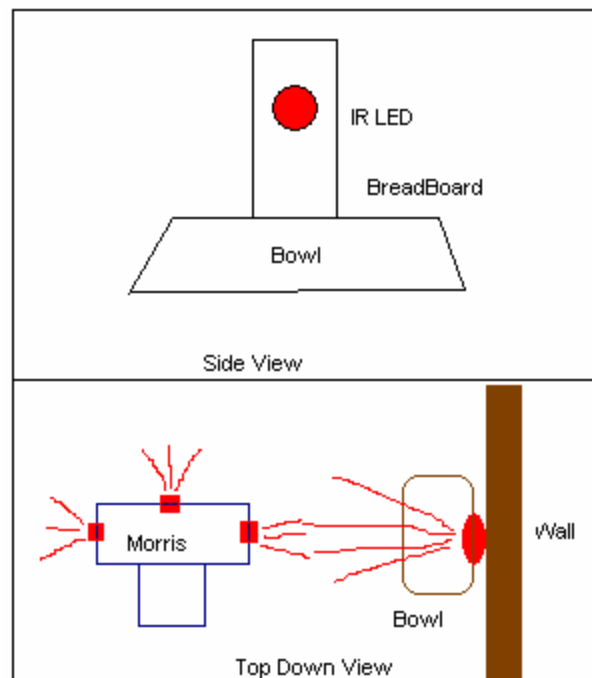


Figure 1

As can be seen from figure 1, one IR LED emitter is mounted to the bowl via a breadboard, which contains all the modulation circuitry required for the IR LED (described later). This breadboard also serves as a means to elevate the IR LED slightly so it can be detected by Morris, which is more elevated than the bowl alone. The only limitation of this approach is the fact that the bowl must be placed near a wall, with the

LED facing perpendicular to the wall. By placing the bowl in this manner, Morris will never travel “behind” the LED and yield the best results for acquiring the bowl.

In order to get the LED to modulate at the appropriate frequency, a 555-timer control circuit is needed. Using a standard 555 timer, the circuit in **Figure 2** is used to generate the appropriate frequency of about 56.5kHz.

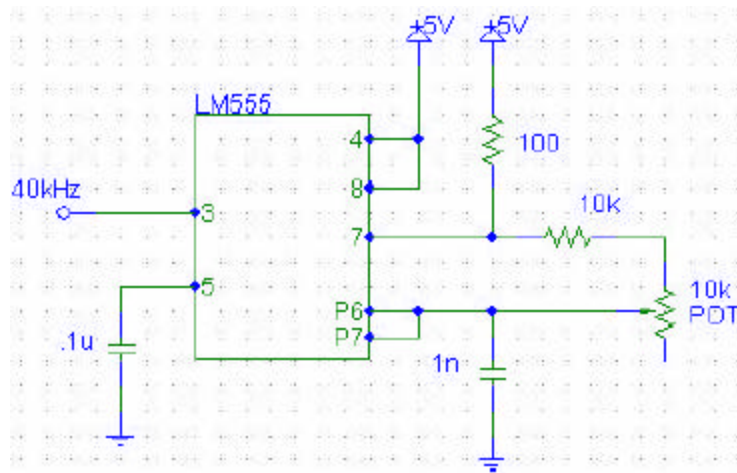


Figure 2

The circuit is fairly simple. The timer is running in the astable mode of operation and has a duty cycle of approximately 48.4%. The pot is used to change the frequency from 56.7kHz down to about 29.9kHz. This allows IR detectors at different frequencies to be used if there are interference problems. This circuit was borrowed from Michael Hattermann’s robot, STEVE.

To power the IR LED circuitry, I am using a simple 5V AC/DC adapter. This will keep the beacon running at all times, and hopefully an outlet will be nearby. In the case where one is not, 4 AA batteries will do the trick, or a 9V battery would do fine as well.

Now that the bowl beacon has been setup, an appropriate detector system is needed on Morris himself. As can be seen above from figure 1, I decided on using 3 IR-detectors mounted on the front, left side, and right side of Morris. The detectors I am using are LiteOn IR receivers, modulated at 56.5kHz. These detectors initially give out a digital signal, but Michael Hattermann discovered a simple hack in order to get an analog signal out of them. **Figure 3** illustrates the hack, which was borrowed from Michael's report.

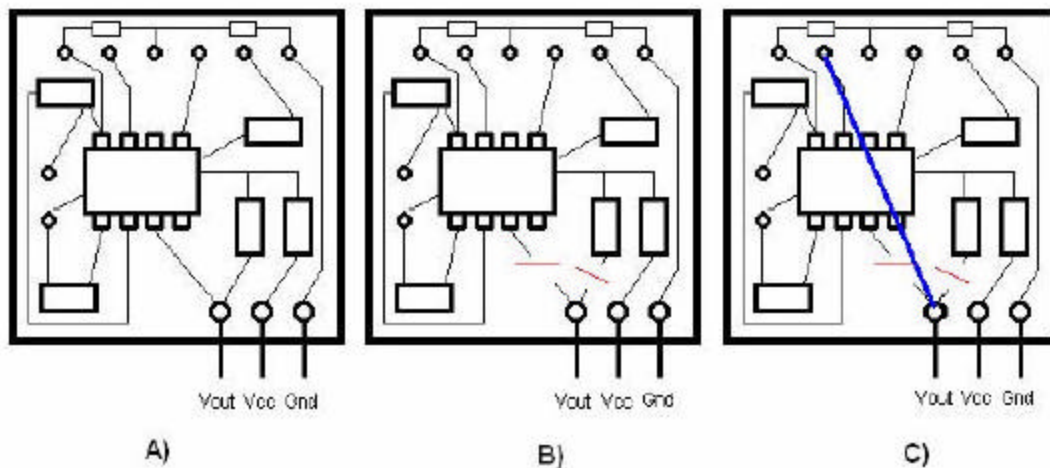


Figure 3

Figure 3 is the inside of the IR can. In order to hack the IR module, first cut the traces to the output pin, which is shown in step B. Then, solder a piece of wire connecting the output pin to the appropriate pin shown in step C. After this hack is complete, the voltage on the output pin is about 1.5V when no IR is detected to about 2.5V when IR is less than an inch from the detector.

Morris' initial behavior is to wander randomly until the beacon is discovered by one of the IR detectors. If the left or right detectors locate the beacon, Morris turns accordingly until the front detector picks up the beacon. Once the front detector locates the beacon,

Morris will move forward at half speed and proceed to “run over” the bowl. A special contact whisker (consisting of a small spring and wire) located below Morris’ chassis is used to detect the edge of the bowl (It is also used as a part of collision avoidance when the IR beacon is not located). If the beacon is found, and the whisker makes contact, the dispenser door is opened for a short time to allow food to be dispensed.

Source for Parts

IR-LED Emitter

Obtained from: IMDL Lab
Price: Free

LiteOn IR Receivers

Obtained from: Jameco Electronics
Price: \$1.95 each
Part #: 176541
www.jameco.com

Small Breadboard

Obtained from: Jameco Electronics
Price: \$5.49
Part #: 20669
www.jameco.com

555 Timer

Obtained from: Radio Shack (Also can get free from IMDL Lab)
Price: \$0.59

Resistors/Capacitors

Obtained from: IMDL Lab
Price: Free