

Door Alarm

Steak Electronics

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1 Overview

Client wants a door alarm. Let's do a few transistors, an audio amplifier board, a magnet and magnetic reed switch, along with a light switch.

Functionality req'd:

Makes noise when door opened.

Able to be shut off with light switch.

2 BOM

Any audio amplifier loud enough will work. I'm going to use this one:

IS31AP4088A-QFLS2-EB

I think I have speakers and transistors. I'll need a magnetic reed switch and magnet. They should be black, as the door is black.

MS-324-3-3-0500

let's also try 59140-1-S-03-A,¹ as first co. doesn't make the matched magnets...

and the magnet,

57140-000

A speaker, although I have plenty in my junk bin. AS07708PS-2-WR-R

That's a start.

3 Work Log: LM324, LM555, TIP120,125

I spent a bit on this during the evening. I tried first with a LM324, in falstad (sim software) to see if I could make a function gen, out of 3 op amps. I was unable to get the sim to work, although reportedly the circuit works online (ref: <https://www.eevblog.com/forum/beginners/simple-analog-function-generator-design/msg1174548/#msg1174548>)

I decided instead, to simulate a triple 5 with a LM324, to finally a transistor output, and this worked in sim. I breadboarded the circuit however, the output was not switching correctly. It turned out later, that I had not read my TIP125 close enough - it is a PNP. Oops.

Before realizing this error, I breadboarded two op amps, (ref: <https://electronics.stackexchange.com/questions/311648/obtaining-a->

¹A and F ending letters on this, A is tinned, F untinned leads

triangle-wave-from-a-square-wave-using-a-lm324n-op-amp) and these were able to make the square / triangle wave without issue. Not practical in this situation however, as the freq. is low. I tried adjusting via the R between output 1 and inverting input for op amp 2, but this did not work as expected. I had long leads with a variable resistance box. Most likely, the issue.

Next, I will breadboard the triple 5 with the LM324 (which may be optional) and use that. I will throw in an Arduino to switch the triple 5 on/off via the RST pin. This will allow for some adjustment of tone.² Future improvements would be to get some way of removing the Arduino from the project. I would need a solution that will adjust how often the RST pin is switched, for some short period of time while the door magnet switch is active.

I might end up just using tone, if the 555 doesn't sound good.

4 Door Magnet Reed Sensor

I tried buying one from mouser,digikey but they are all small. Seems the standard is 28mm by 10mm or so. I didn't realize it until I purchased it, but it looks quite a bit smaller than I am used to. Not acceptable.

I spent some time looking at all the options. I was unable to find the bigger size. Even the imports from Sparkfun and Adafruit were small. There was a nice screw terminal omron option but it was \$30. I opted for ebay where there were some used, brand name, sensors in the US. I found some for about \$5 each, including magnet AND the sensor (on mouser/digikey, you often have to get them separately).

4.1 Buzzer or Bell

I thought about a buzzer. Like, a ringer from a telephone. I didn't find them on mouser/digikey, but I did see a lot of piezo buzzers. Need to look again. Even better would be a bell, but that requires an actuator or a motor. I don't want to deal with moving parts, it

²I could just use the tone() function on the Uno, and have a transistor handle the output, but the goal of this project was to lean more towards the analog.

will be more likely to break. Let's put that idea aside for another day.

Still, I like the idea of a bell, and an actuator to ring it...

I tried one on ebay. If that doesn't work there is this one: <https://www.allelectronics.com/item/sol-154/12vdc-push-type-solenoid/1.html> per this discussion: <https://forum.sparkfun.com/viewtopic.php?t=10308>

As for the bell, I will hold off until I know how the solenoid works.

3

4.2 Signal Mosfets for Actuator

I have a solenoid, from ebay (actuator) and I've got a bell⁴.

I tried some 2n7000 signal mosfets (to-92), and I am unable to get it to work. I think it's due to current limits (200mA). These, the 2n7000 have protection diodes built in, according to data sheet image.

In any case, I set up the small npn transistor with 1k to base (grounded) and a 12V battery, with the motor on the collector/drain side. What happens is that it doesn't switch (as it shouldn't) when base is grounded, but float the base, and it switches on, sometimes. Eventually, it will just turn on no matter what, whether base is grounded or not. As I mentioned, these to-92's can't handle the actuator.

I could always use a relay, but that wasn't the point. I'm trying to get the transistors to work. I also tried a TIP120, NPN, darlington mosfet, but this didn't work on the perf board, and I moved to the 2n7000.

EDIT: I was able to get expected results from the 2N7000, by not forgetting the diode across the motor. Put gate low, it is off. Put gate high, it is on. However, it latches. I have to put the gate low again in order to get it to turn off...

A solution to remedy this is to hold the base/gate at ground with a 2.2K R, then short the base HI (12V here) to turn it on (quickly, and shortly) before letting it go back to ground. Seems to

³I decided that the sound of the bell is worth the risk of using moving parts.

⁴I ring it in the morning... I ring it in the evening...

work with no ringing at GND after coil is off. Or, just use an arduino and wire to IO.

Also, I definitely did blow some of the Mosfets, without the diode on the motor. They have their own protection, but that isn't enough by itself.

In other news, the bell is looking like a better solution than the speaker I considered before. More moving parts, but worth it.

5 Basic Circuit Ready

I have built the circuit with a to220 mosfet, with 12V on the source, and powered by a 5V IO from an Arduino uno going through a 1K resistor before hitting the gate. It hits the gate at 1.3V about. Around 1Volt, it lightly sets off the actuator, 1.06V the actuator is fully activated.

Wanted to use a 555, but no time for that today. Next step is to build the enclosure around everything, so the bell is hit correctly. Wood may be too much of a fire hazard. Need to think about this. Looking up building materials that are resilient to fire comes up with stone, basically. Glass, concrete, stucco, gypsum, and brick. I like the glass option. I think I will go with that. Not going to be easy, but fireproof. I have a lot of glass hanging around after demoing some windows. Another option might be to use some drywall, and build something with joint compound. A type of wall box... Hm... Easier than glass. Either that or a plastic box, larger than I have. Or, metal box.

5.1 Breaking the Actuator

Actuators are like brushed motors, in that there is a connection from the coil. I have a jigsaw with two brushes on the side. They are these carbon blocks. Actuators are the same, yet the spring is the brush.

Today I was assembling everything for final deployment, and I accidentally hit the spring with a screwdriver. The spring broke, and I was unable to find a replacement in my box of springs.

Replacement part needed. It also turns out that the actuator wasn't really loud enough. I'm going to spec one that is a bit stronger. Other than that, everything is built.