# Digital Counter Bell Development

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## Version 1

The first version is a proof of concept. The idea was to in the fastest and cheapest way play a digital sound using the counter bell, leaving the bell intact in case the project would fail.

Parts used:

- Toy car key (plays audio when pressing a button)
- Counter top bell (non modified condition)
- Stranded wire
- CR2032 Battery + Battery Clip
- Computer chassi speaker (made little difference from the toy speaker)


### Finished Product

**Images** (Click to enlarge)

**Video with Audio**

counterbellv1-video-sound.mp4

**Challenges**

- Finding a cheap toy that plays a short audio clip by the press of a button. It's components had to fit inside the counter top bell.
- The biggest challenge was getting the original counter bell button to press the toy button. This was done by fastening the sound chip with electrical tape.

**Conclussion**

In terms of requirements, version 1 succeeded in requirements 1(preserve original presentation) and 2 (powering) but failed 3 (Loudness). In addition, the main feature of playing custom audio files does not exist. This version was put together in a fast manner and fails to uphold a standard of quality. Note that the battery is not easily accessible but can be easily created by cutting a hole (as done for the speaker) in the cardboard. This allows access to the battery holder and battery.

This was the first version and a success and proof that this could work.

## Version 2

This is the first iteration that will allow custom audio. We will be using the same counter bell but everything else will be swapped out. The following parts are needed (could potentially change over the duration of the version)

- Adafruit Audio FX Mini Sound Board - WAV/OGG Trigger - 2MB Flash
  - Product page
  - Adafruit Tutorial for chip
- Speaker (4Ohm, 3w), Diameter: 2-3“, Prefered is 2x 2w speaker from the sound board.
- Power source - probably need a power pack of sorts, Need to be 3-5v (5v louder).

I've ordered the following items in the image below. I purchased both a rechargeable poly ion battery as well as a simple 3xAA battery holder (for testing, will most likely not fit in actual product). There is also a USB charging chip for the poly battery and is also for testing purposes and not a necessity at this point. The large speaker will potentially not fit and will require the construction of a laser cut acrylic base. This should not diminish the original

| | | | |
|---|---|---|---|
|  | Speaker - 3" Diameter - 4 Ohm 3 Watt SKU:ADA1314 | $2.96 | 1 |
|  | Adafruit Audio FX Mini Sound Board - WAV/OGG Trigger 16MB Flash SKU:ADA2341 | $18.10 | 1 |
|  | 3-AAA Battery Holder SKU:POLOLU-1144 | $1.20 | 1 |
|  | Polymer Lithium Ion Battery - 400mAh SKU:PRT-10718 | $8.99 | 1 |
|  | Adafruit Micro Lipo W/MicroUSB Jack - USB LiIon/LiPoly Charger - V1 SKU:ADA1904 | $10.36 | 1 |
|  | Digital Push Button SKU:DFR0029 | $4.65 | 1 |

**Challenges**

- Fitting everything in the housing
- Getting enough volume out of the battery
- Battery life

**Conclusion**

This version was a success. There we a couple of things that I wanted to improve, which was the price of the whole project as it was fairly expensive at this point. I haven't previously taken into account the cost of the bell, which in retail costs $12 or more in some cases. A second thing that I found a little annoying is that it got way to crowded and the cabling was difficult to handle when everything was crammed into the housing. A breakdown of this version:

- Speaker too large, luckily I had access to a number of smaller (2-3W) speakers.
- The Adafruit Sound boar didn't come with built in amp (as suspected), Tried cheap Chinese amp circuit and Adafruit's 2.5W mono amp. The latter was the best option due to simplicity and quality.
- The overall ensemble of circuits boards and cables fit into the housing, although it was very tight and messy.
- A way of pressing the button is still required, preferably using a spring.
- Charging the battery via USB works well.

- Battery life was over 12h with little usage (more testing required).
- Volume with Adafruit amp was very good.
- Push button was overkill (and expensive)

## Version 3

There are plenty of changes in this version. After a lot of research and a little luck I have managed to get the price of the components down by more than half. We can easily remove the amp and the expensive soundboard and replace it with a mini mp3 player by DFRobot which takes micro SD cards and can power speakers less than 3W. It's size is about half the size of the soundboard and relinquishes the need for a separate amp. As luck would have it, this circuit can be bought at a fraction of the price from oversees.

I have managed to find a desk bell for $2.80 locally which is a big difference to the retail version I've used in the past.

So hopefully this version will be smaller, use less wires, cost a lot less and be more energy efficient (as a result of less components). Also hoping to find a solution for a button that feels good and also a way to mount the components inside the bell.

### Parts

- DFPlayer ManualDFRobot | Aliexpress **$2.55**
- Counter Bell Daiso Online **$2.80** (Cheaper online, in bulk)
- 3.7V 560 MAH Lithium Ion Battery Aliexpress **$3.80** (per piece in lots of 10)
- Momentary Limit Switch eBay **<$0.50**
- TP4056 5V 1A USB Charging Module eBay **<$0.30**
- Hookup Wire
- Laser cut Support for button, 6mm
- USB Cable (for charging)
- Micro SD Card 8Gb Aliexpress **$3.82**

### Challenges

The mini MP3 player has only two triggers which means that a single trigger will do several tasks based on how long it has been pressed. This could lead to some problems considering the next button (aka the play button) which we would use as the bell trigger, when held, would continuously reduce the volume.

*Phil to break down outcome*

## Version 4

As the previous build refined the cost and performance in components. This version aims to refine the

housing of the components inside. The idea is to add a false base to the counter bell without changing the bell structurally. It is worth noting, at this point, that we are now in the stage of compromise. Version 3 worked for all intents and purposes. To add functionality like Charging the battery while the bell stands upright and remains operational and to ensure that every successful build will be identical, we will need to work the housing of the project. The plan is to add a false bottom to the bell and add extra space for the components to be housed. We also need to substitute the current choice of speaker as it is not possible to source large quantities of that particular size. The final objective its to make the build solderless for participants.

**Parts**

**The parts will be the same as version 3 with the addition of;**

- Solderless cabling.
- 38mm Bolts.
- An extra 4mm layer of acrylic for the base (6mm is our only available size for this purpose at this point).
- Substitute the 3Watt 4OhM speaker for a pair of 1Watt 8Ohm Speakers Aliexpress $18.30 for lot of 50.

**Challenges**

Adding the new layer of acrylic base will raise the price slightly, I will need to ensure that I don't add any more than required. The new design will see the components glued to the base. This can cause issues with reparations. Retaining as much of the original aesthetic as possible.