A 'Retro' Mobile

Give an old phone a second life

Thijs Beckers

Old-fashioned bakelite telephones are becoming increasingly rare in living rooms, but they're still common enough at rummage sales. We like convenience in our lives and our tools, and a phone that isn't attached to the wall by a cord is simply more convenient. So it's 'out with the old, in with the new' where phones are concerned.

Phone

Stop! Don't throw away your old phone! You can give it a second life using the circuit described in this article. That makes a nice Christmas present (maybe a bit belated) or gimmick, although it's naturally a bit too heavy to carry around wherever you go. However, it's perfect on your desk at work or in the pub. You're bound to draw a second glance or be accused of being off your head, but that will change when the phone rings – despite not having the usual cable – and you start having a lively conversation.

What's inside

Old phones are primarily based on mechanical systems, because there weren't any PICs or microcontrollers fifty years ago. The mechanism behind the dial is no longer used, but that doesn't mean it wasn't a well-considered design, far from it.

Figure 1 shows how it works. When you dial a digit, the small, grey oval wheel (arrow 1) rotates once for every two digit positions while the dial is returning to its starting point. As a result, the contacts (arrow 2) generate a pulse for each digit position on the dial. The microcontroller uses these pulses to determine which number you dial.

Figure 2 shows the mechanism with the dial in the rest state. The other set of contacts (marked by the arrow) is open in this state. That tells the microcontroller that the dial has stopped rotating.

We use a 16LF88 microcontroller here. **Figure 3** shows how it is connected to the rest of the circuit. The firmware can be downloaded free of charge from our website.
A 3.7-V lithium polymer battery provides the supply voltage. Although the minimum supply voltage is specified as 4 V in the 16LF88 data sheet, it still

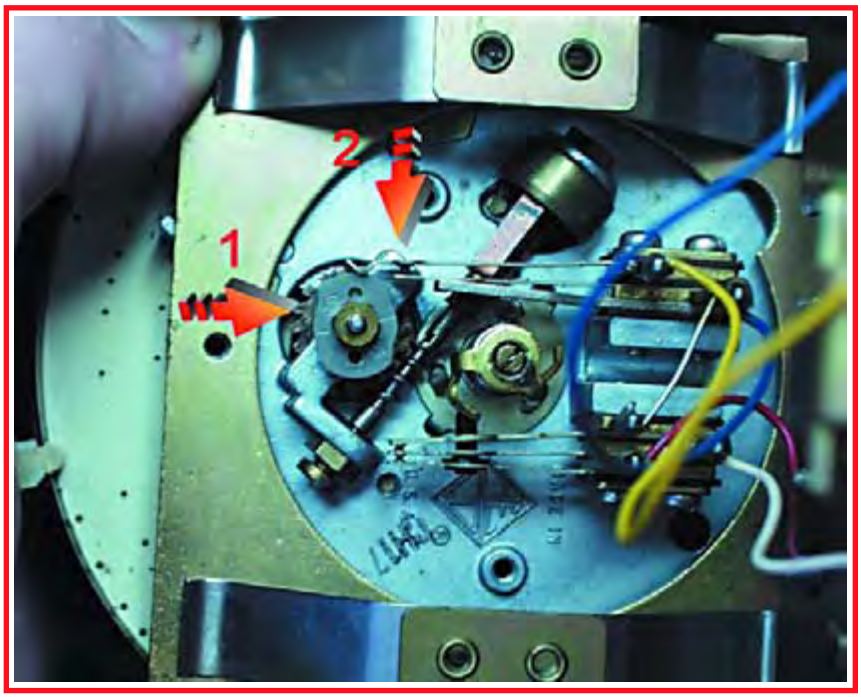

Figure 1. **Good news: the mechanical construction of a 50-year-old phone is compatible with modern microcontrollers. The small grey wheel generates a series of pulses after you turn and release the dial.**

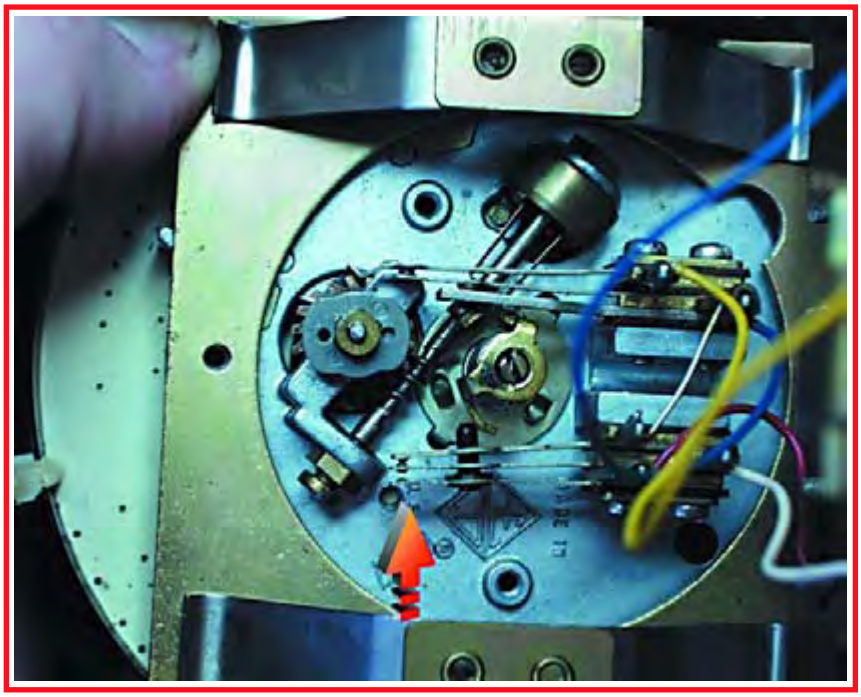

Figure 2. **The lower set of contacts (see arrow) provides an electrical indication that the dial is at rest.**

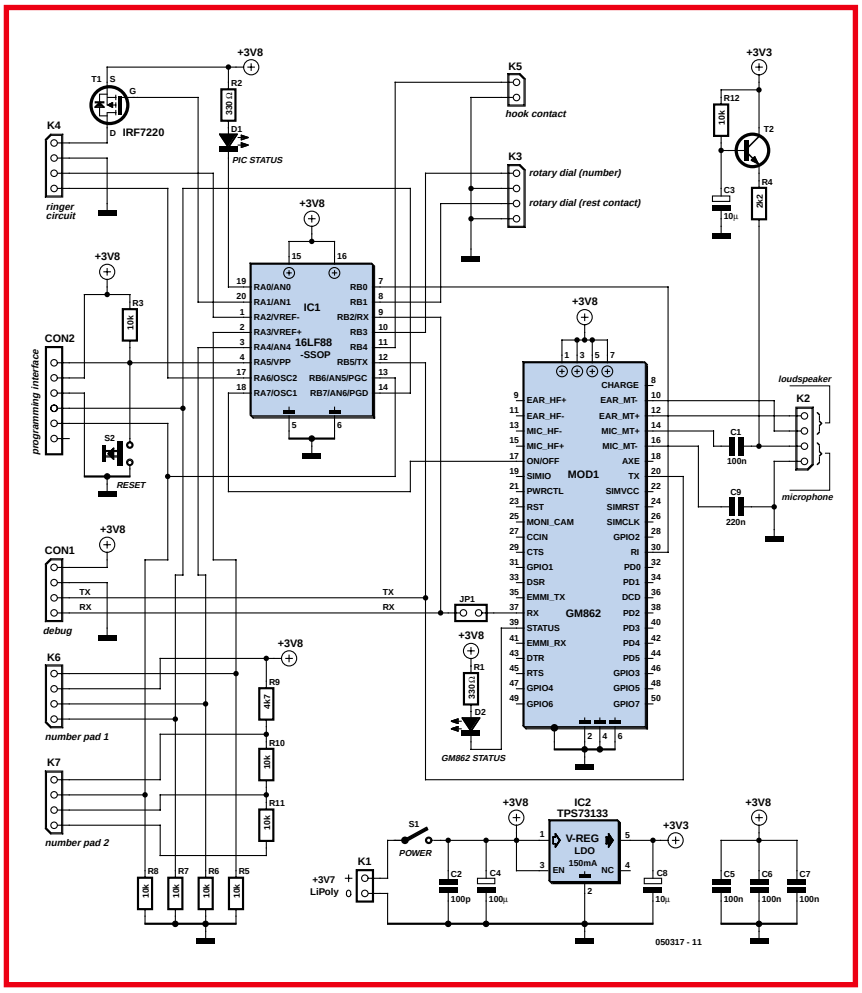

Figure 3. The schematic diagram of the control unit for the circuit. Most of the circuitry is contained in the GM82 and 16LF88, so only a few external components are necessary.

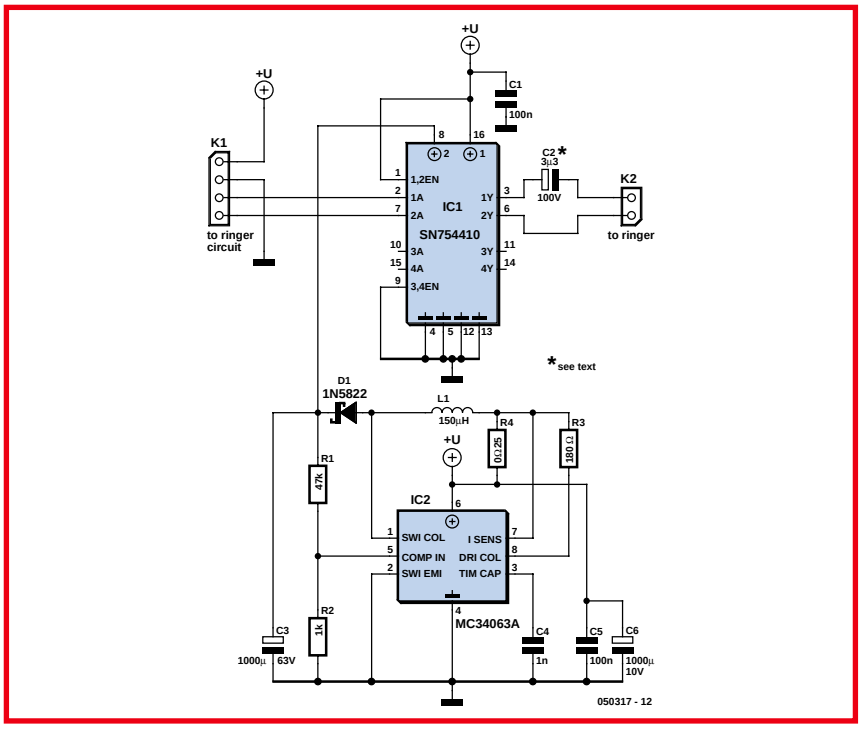

Figure 4. The schematic diagram of the boost converter. This circuit generates the relatively high voltage needed to drive the electromagnetic ringer.

works at 3.7 V (actually 3.8 V). The GSM module draws a peak current of around 2 A, which is more than most voltage regulator ICs like to provide, but a LiPo battery simply shrugs its shoulders.

The GM862 module comes from **Spark Fun Electronics**. It is a GSM module that can handle three bands: 900 MHz, 1800 MHz and 1900 MHz. The microphone and speaker of the telephone are connected to it via K2. The module can drive most types of speakers directly. The sensitivity of the microphone input is 50 mV, so you can probably manage without amplifying the microphone signal. A coupling capacitor and a resistor connected to the supply voltage to power the electret microphone should be sufficient. Connect the dial contacts to K3 and the 'off-hook' contact to K5.
The GSM module can be controlled by the PIC using AT commands. CON1 and CON2 provide convenient debug access. K6 and K7 were added for connecting an optional keyboard, and they can be omitted.

The ringer circuit is energised via K4 (see **Figure 4**). It has the difficult task of converting a 3.8-V DC signal to an AC voltage at around 60 V. A boost converter followed by an H bridge is used for this purpose. The relatively high voltage is necessary to make the clappers strike the bells with sufficient force. The frequency of the AC voltage determines how fast the bell rings. The ringer coil and C2 form a resonant circuit with a frequency of approximately 22 Hz. Of course, the value of C2 can be adjusted to suit the electromagnetic ringer used in your phone.
If all of this is a bit too much work for you, you can visit the Spark Fun website to order a ready-made telephone.

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Web link:
www.sparkfun.com