

The Musical Stick

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Introduction

As one of the first tools used by man, the stick is simple, yet versatile. The first men could use a stick as a weapon against other nomadic barbarians, a skewer to eat meat and vegetables, a probe for investigating strange areas, a backscratcher for itching pains, or any other task that benefited man by extending his arm. Therefore, it seemed logical that this tool be our starting point for the design of our first electronic instrument.

The Hardware Design

The PVC pipe quickly became the obvious choice for implementing our stick concept. It provided both a sturdy structure and a hollow inside for easy mounting and wire-handling. To fully utilize the performer's hand and arm movements, we added eight pushbuttons (to be played with the fingers), a three-section continuous ribbon sensor (to be played with the thumbs), and a two-axis accelerometer (to be controlled with wrist and arm movement). We mounted the pushbutton controllers equidistant from the center of

the pipe's length so that the pipe would be easily maneuverable and the accelerometer (mounted at one end of the pipe) would be easily manipulated.

The Wiring

In the construction of the musical stick, my primary task (as the token electrical engineer) was overseeing the wiring of the each hardware component. Due our lack of experience in ordering electronics components, however, we foolishly purchased the accelerometer built with surface mount technologies. While this kept the size of the chip to tiny proportions, it required a meticulous soldering technique.

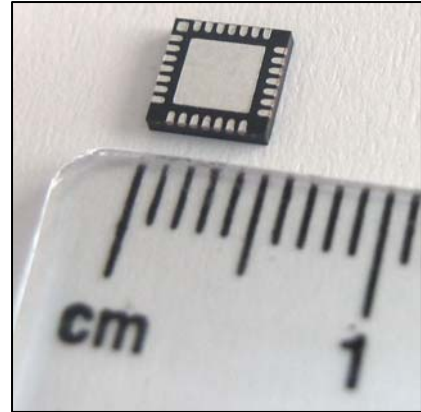


Figure A: Example surface mount chip. [Photo courtesy of Wikipedia]

After several practice trials off the chip and one trial on a “no connection” lead on the chip, I developed a sufficient three-step soldering technique to connect each lead. First, lay and hold the end of a wire on top of the desired lead with one hand. Second, with the other hand, melt enough solder onto the soldering iron so that just a small glob appears on the iron's edge. Third, quickly but lightly dab the soldering iron edge onto the wire and lead once or twice. If done correctly, the wire and lead should be neatly soldered together.



Figure B: Pushbutton wiring

Keeping the wiring neat, reliable, and functional became another challenge. While the PVC pipe helped cover much of our wiring, it also helped to create a large jumble of wires inside the pipe that often made further wiring more difficult. Professor Lehrman suggested the use of a long, uninsulated wire to connect the common voltage source between each pushbutton. This strategy proved to be

difficult, however, since the wire could not be easily maneuvered inside the pipe to connect it to each pushbutton lead. Using an uninsulated wire would have also risked possibly creating shorts inside the PVC pipe and causing intermittent hardware problems. Thus, we decided to connect each pushbutton neighbor together with separate wires.

We also encountered a couple other minor difficulties. Due to my fear of incorrectly wiring the pushbutton's common voltage wiring, I did not solder to wires but instead tightly wrapped them around the pushbutton leads. During our testing, the wire on the first button came loose, causing every button to cease operation. The problem was easily fixed, but became an important lesson about the utility of solder. Also, during the final testing phase, the ribbon sensor (which had been tested and worked well previously) stopped operating properly over three-fourths of its length. While we are unsure of the cause of this breakdown, the hardware failure may have been due to poorly secured wires, which were held in place by electric tape.

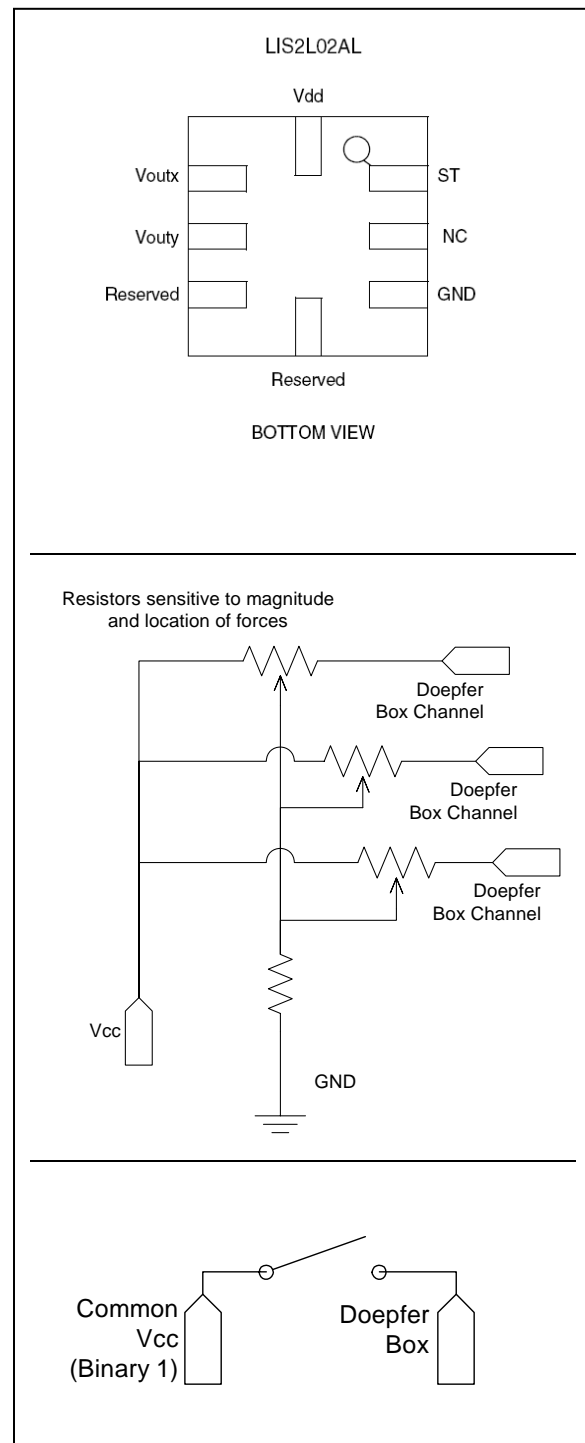


Figure C: Wiring diagrams for the accelerometer (top) and electronic schematics for the ribbon sensor (middle) and a pushbutton (bottom)

Conclusion

In general, our project was very successful. The team accomplished every goal that we set out to do in our proposal. However the project was not without its difficulties, which brings to light a couple ideas for the next project. While a large stick is a versatile tool, it is also unnecessarily large as a simple electric instrument. I think we can create a more expressive and usable instrument from a smaller chassis. Also, the greatest hindrance for playing and building the instrument was the mass of wires coming out of it. For the next project, I would like to try to use the available wireless systems or design the next instrument so that the wiring can more user-friendly.