

VEX Robotics Reverse Engineering Online Challenge
Sponsored by Texas Instruments

Inner Workings of a Flashlight

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Introduction

A pocket flashlight was chosen for this project. Such items are commonplace in homes, and their utility is used in many scenarios yet not many people know how it functions, including me, and it is my job here to display the inner workings of this flashlight for the sake of learning how a staple household device works.



Figure 1. Demonstration of how a pocket flashlight would be used

Disassembling Procedure

I first donned safety goggles before anything was taken apart. I then placed the flashlight on sheets of paper for visibility and a clean workspace.



Figure 2.1. Front View of flashlight before deconstruction

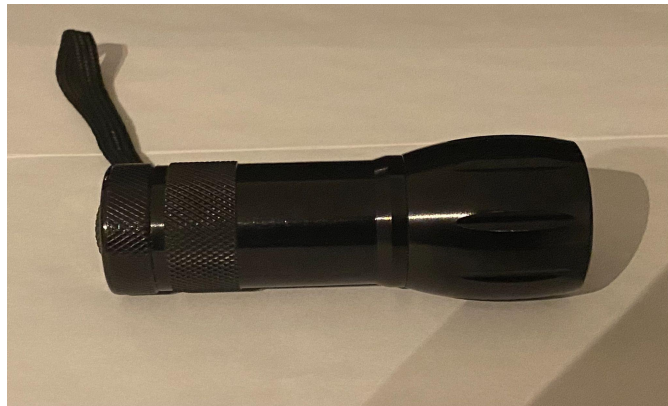


Figure 2.2. Side View of flashlight before deconstruction

I then took the head off the flashlight by unscrewing it from the body.

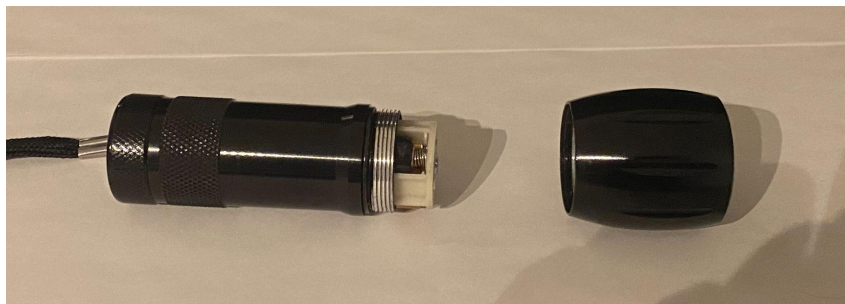


Figure 3. Flashlight with head removed via unscrewing by hand

The battery holder was removed by pulling it out of the body. Powering the flashlight were three triple A batteries.



Figure 4. Flashlight with battery holder removed by hand

I removed the tail of the flashlight by unscrewing it from the body.



Figure 5. Flashlight with tail removed via unscrewing by hand

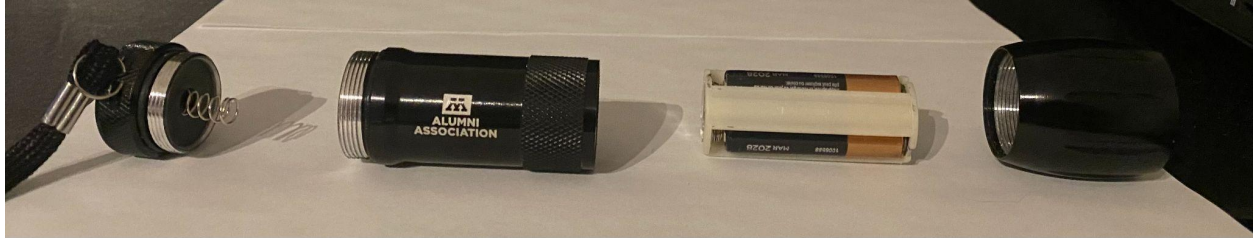


Figure 6. The 4 major parts of the flashlight
(Battery Holder, Body, Head, Tail)

The battery holder is made of plastic, an insulator, so excess charge can't be discharged. The battery holder has electrical contact with the battery terminals for current to flow. Coiled spring wire is pressed against the battery terminals to make that electric connection.

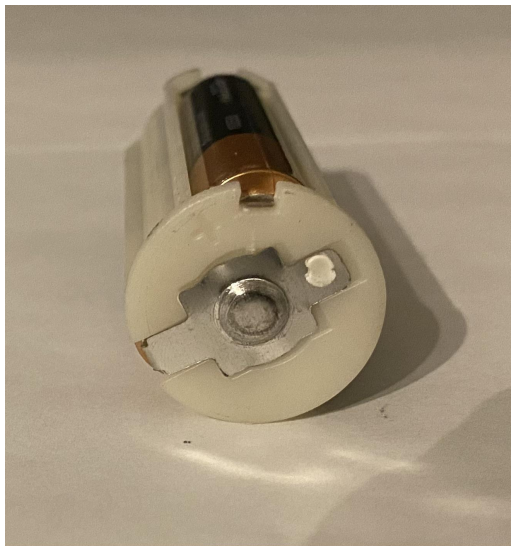


Figure 7.1. Battery holder
front view



Figure 7.2. Battery holder
side view

The body is a central piece for the battery holder and for the head and tail to be screwed into.



Figure 8. The body of the flashlight

The head of the flashlight has a coiled spring to connect to the battery holder. Inside the head is a PCB Board which is powered by the current flowing from the battery holder to the spring. The board powers all nine lightbulbs when it receives current.



Figure 9.1. Inside of the Head



Figure 9.2. Front face of the Head

The tail of the flashlight contains a coiled spring wire that connects to the battery holder. On the back, there is a push button that turns the flashlight on and off.



Figure 10.1. Side view of the tail



Figure 10.2. Push button on tail

The cover of the pushbutton and the rubber below the spring was removed with needle nose pliers. It revealed the pushbutton works by a plastic knob pushing a metal lever into place to be in contact with the coiled spring.



Figure 11.1. Push button cover removed



Figure 11.2. Push button lever

The flashlight shines when the circuit is closed, and the user presses the pushbutton to trigger that. An approximation of the circuit of the flashlight is shown in figures 12.1 and 12.2.

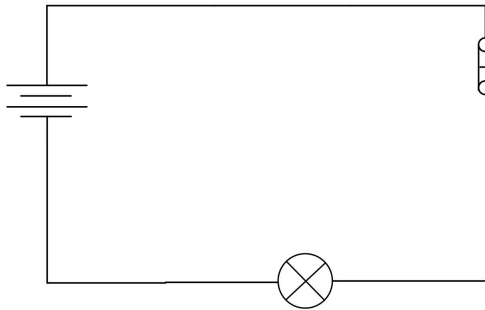


Figure 12.1. Circuit closed with activated button

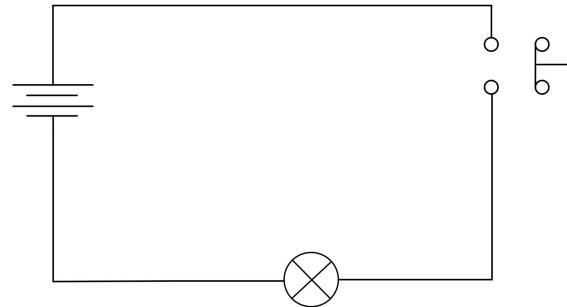


Figure 12.2. Circuit open with unactivated button

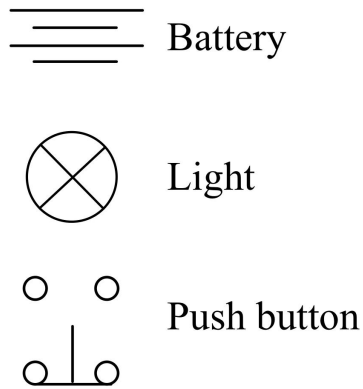


Figure 13. Key for figures 12.1 and 12.2

Conclusion

To summarize how this flashlight works, I'll start from the tail. The user pushes the button on the back which then pushes a metal lever to be in contact with a coiled spring wire. This wire is connected to one of the faces of the battery holder, which completes the circuit of the flashlight. Once the circuit is complete, the current will flow through the battery holder to the coiled spring wire on its other face. That wire is connected to a custom PCB Board in the head of the flashlight so that when given current, powers the nine light bulbs on the front face of the flashlight. During the process of this project, I learned about how basic push buttons work devices as well as how most dry cell battery holders are designed and how these components work together.