

### Activity:

Create a simple robot that can draw its own designs! We will hook up a simple DC motor battery in order to make a simple fun robot that wiggles around on a piece of paper and makes its own unique art.

### Applications:

All robots need a power source and one or more motors. Robots includes drones, manufacturing robots and self-driving cars. Engineers make motors for all kinds of machines including toys and washing machines. Robots are very important as they can do many tasks for disabled people, search radiation rooms, make coffee and go in places humans can't go such as space exploration.



### Further Information:

Lego Mindstorm Information: This demo utilizes a LEGO NXT Mindstorms robot. These robots are made out of LEGOs and can do many different types of tasks.

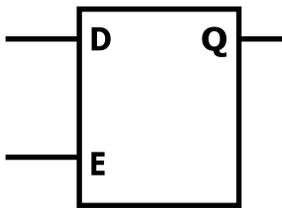
<http://www.lego.com/en-us/mindstorms/?domainredir=mindstorms.lego.com>

FIRST Robotics:

<https://www.firstinspires.org/> – FIRST Robotics, an organization that hosts robotics competitions for all ages.

**Applications:** Teams of engineers worked for years to perfect every device that you use. Every device that has power had an Electrical Engineer on that team.

**This Project:** This is an antitheft circuit. It can show if something has been tampered with, even if things were put back the way they were. The toggle switch arms or disables the circuit. When the circuit is armed and the photoresistor is uncovered, the LED will light up. The LED will not turn off until the toggle switch is turned off. This system works due to the integrated circuit (IC) chip. It is a gated D latch, which is a component used to store data in the form of 1's and 0's. It has two inputs, D (data) and E (enable), and one output, Q. When E is 1, Q is equal to D, whether it is 1 or 0. When E is 0, Q latches to its current state, and will not change.



Gated D Latch

E	D	Q
1	0	0
1	1	1
0	Doesn't Matter	Current State

Truth Table (shows possible input and outputs)



The photoresistor is a component that behaves differently in the light than in the dark. It is connected to the E input of the gated D latch. When the photoresistor is in the dark, it sets E to 0, so the output Q does not change. When the photoresistor sees light, E will change to 1, and the output Q will change based on the input D. The toggle switch is connected to the input D. When the switch is on, D is 1, and when it's off, D is 0. The LED is the small light bulb connected to the output Q. When Q is 1, the LED will turn on, and when Q is 0, the LED turns off.



The trick to the antitheft circuit is that the only way to turn it off is with the toggle switch, which would presumably be hidden. If the owner wants to de-arm the circuit, they can turn off the switch whenever they wish. If the owner places the photoresistor by a door or under the lid covering their last piece of cake, they know if the LED turns on that someone tried to steal their stuff! To make it even more noticeable, a buzzer can be connected to the LED, creating a noise when the LED turns on.

### Further Information:

- [AllAboutCircuits.com](http://AllAboutCircuits.com) – A good resource for questions about electronics. The website has educational information about circuits, including electronic textbooks, video lectures, worksheets, and more. Click on the 'Education' tab at the top of the page to get started.