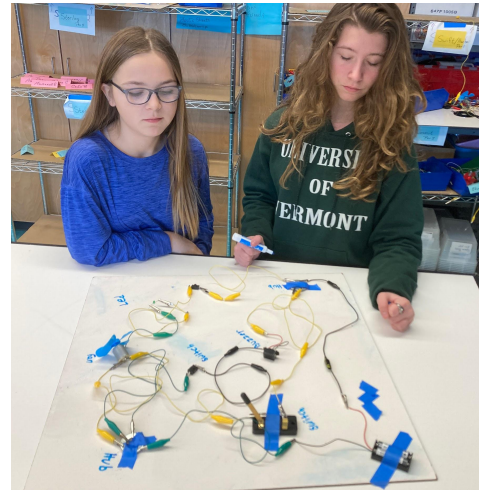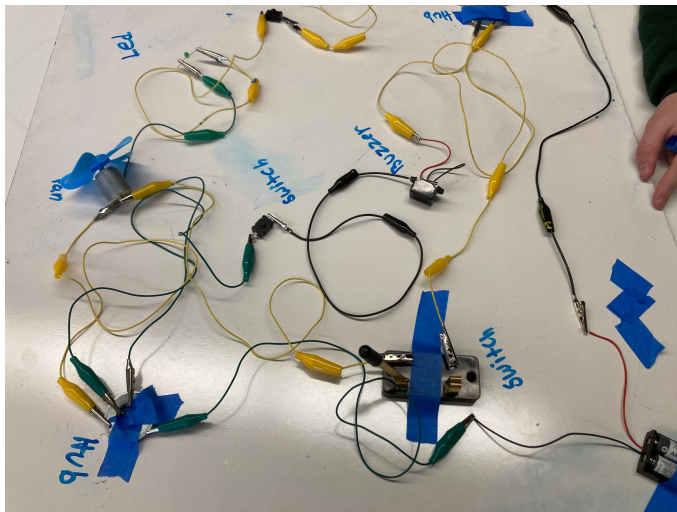# Creating a complex parallel circuit using motors, led's and buzzers with multiple switches

Grade level(s) I use with: this has been a great lesson for 7th and 8th graders, the next step after we spend 5th and 6th really solidifying the basics of simple circuits.

Lesson Overview: - the challenge I give to students for this project is pretty simple, create a single circuit that can use two AA batteries to independently control three different components: typically an LED


light, an RC motor and a buzzer. They have access a variety of switches (button, bayonet, typical light switch, etc) and as an introduction we review the concept of a parallel circuit since their typical first approach of a series circuit won't work to activate everything nor will it allow for any independent switching. From that point on it's a couple days of experimentation; getting lost in a maze of alligator clips which I also allow to be chaotic as they discover the value of using a variety of different colors to help identify which circuit is which. I have a set of 24 x 24 inch whiteboards where they can tape things down and label with whiteboard markers - in the end every group is usually able to come up with a viable solution.

The assessment is a short flipgrid where I ask them each to demo the circuit and talk me through how the circuit works. Once I know they can put this together they are ready to move on to the Operation Game project where they take the idea of a parallel circuit to create a game with two or more components that open / close based on a single switch - hopefully much more clear after this little formative assessment.
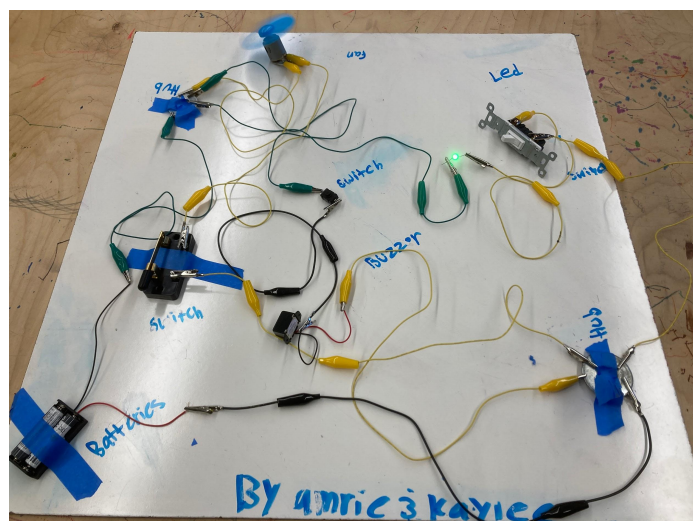
This also is a good pre-lesson preparing students for the lessons using circuit boards that I use to try to explain the basics of computer memory since it really helps them understand the function of a switch in a circuit. With this solid we will make the connection to the transistor as a electrically activated switch that can be built into a circuit as a flip flop that can store data. Depending on the time I have to commit to the lesson, this can also be combined with a little creative design, asking students to use lego, pipe cleaners and other makerspace supplies to model how this circuit might actually be useful in life (such as a model house with a light, ceiling fan and doorbell). This can be a nice addition but also adds a couple days to the assignment - just depends on the length of the cycle.

Materials and equipment I use:

For making the circuit:
alligator clips (usually about 12 per group),
https://www.amazon.com/Alligator-Electrical-21-5inch-Connection-Experiment/dp/B0995KJWR5/ref=sr_1_3_sspa?crid=3DXZKQHMIRIPP&keywords=alligator%2Bclips&qid=1703816749&s=industrial&sprefix=alligator%2Bclips%2Cindustrial%2C119&sr=1-3-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1
rc 1.5 volt motors
https://www.amazon.com/SGHAJIME-Electric-5000-20000RPM-Projects-Airplane/dp/B0CGVN9YQQ/ref=sr_1_10?crid=320W7ZBFWAD3Q&keywords=1.5%2Bv%2Brc%2Bmotor&qid=1703816261&sprefix=1.5%2Bv%2Brc%2Bmotor%2Caps%2C121&sr=8-10&th=1
Plastic propellors for easy visibility whether or not the motors are activated
https://www.amazon.com/EUDAX-Propeller-Airplane-Science-Education/dp/B073XL73F6/ref=sr_1_9?crid=1NI4MUVPYZONN&keywords=plastic%2Bpropellers&qid=1703816345&sprefix=plastic%2Bpropellors%2Caps%2C131&sr=8-9&th=1
AA batteries and double holder with leads,
https://www.amazon.com/WAYLLSHINE-12Pcs-Battery-Holder-Leads/dp/B013GNC08C/ref=sr_1_4?crid=Q9BFBF0ZK8YD&keywords=2%2BAA%2Bbattery%2Bholders&qid=1703816189&sprefix=2%2Baa%2Bbattery%2Bholders%2Caps%2C124&sr=8-4&th=1
simple LEDS (I find green works the best unless you want to incorporate resistors to assure proper voltage across the circuit),
https://www.amazon.com/DiCUNO-450pcs-Colors-Emitting-Assorted/dp/B073QMYKDM/ref=sr_1_6?crid=1ESN0SR07EZH6&keywords=leds&qid=1703816149&sprefix=leds%2Caps%2C130&sr=8-6
1.5 volt buzzers.
https://www.amazon.com/tatoko-5PCS-Mini-Buzzers-Leads/dp/B07R19JLPX/ref=sr_1_1_sspa?crid=11HF7K0HHQWJD&keywords=1.5+volt+buzzers&qid=1703816096&sprefix=1.5+volt+buzzers%2Caps%2C179&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1

For switches
Bayonet switches
https://www.amazon.com/QWORK-Educational-Electrical-Connection-Laboratory/dp/B0CH7VZCWM/ref=sr_1_1_sspa?crid=2ZDFLG2PROFHN&keywords=guillotine%2Belectrical%2B

switches&qid=1703816490&sprefix=guillotine%2Belectrical%2Bswitches%2Caps%2C103&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

Rocker switches

https://www.amazon.com/5Pcs-Rocker-Switch-Position-QTEATAK/dp/B07Y1GDRQG/ref=sr_1_11_sspa?crid=2XFNELMJJCJR1&keywords=bayonet%2Bswitches&qid=1703816449&sprefix=bayonet%2Bswitches%2Caps%2C119&sr=8-11-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9tdGY&th=1

Basic light switches

https://www.amazon.com/Sunlite-E506-CD-12PK-Grounded/dp/B06XZ29X1M/ref=sr_1_13_sspa?crid=2XFNELMJJCJR1&keywords=bayonet+switches&qid=1703816393&sprefix=bayonet+switches%2Caps%2C119&sr=8-13-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9tdGY&psc=1

Button switches

https://www.amazon.com/Momentary-Button-Switch-Assorted-Self-Resetting/dp/B08SKJ6V7Z/ref=sr_1_7_sspa?crid=2Z15JNNXITS9T&keywords=button%2Belectrical%2Bswitches&qid=1703816537&sprefix=button%2Belectrical%2Bswitches%2Caps%2C109&sr=8-7-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9tdGY&th=1

https://www.amazon.com/gp/product/B07C8FL5RW/ref=ppx_yo_dt_b_search_asin_image?ie=UTF8&psc=1