

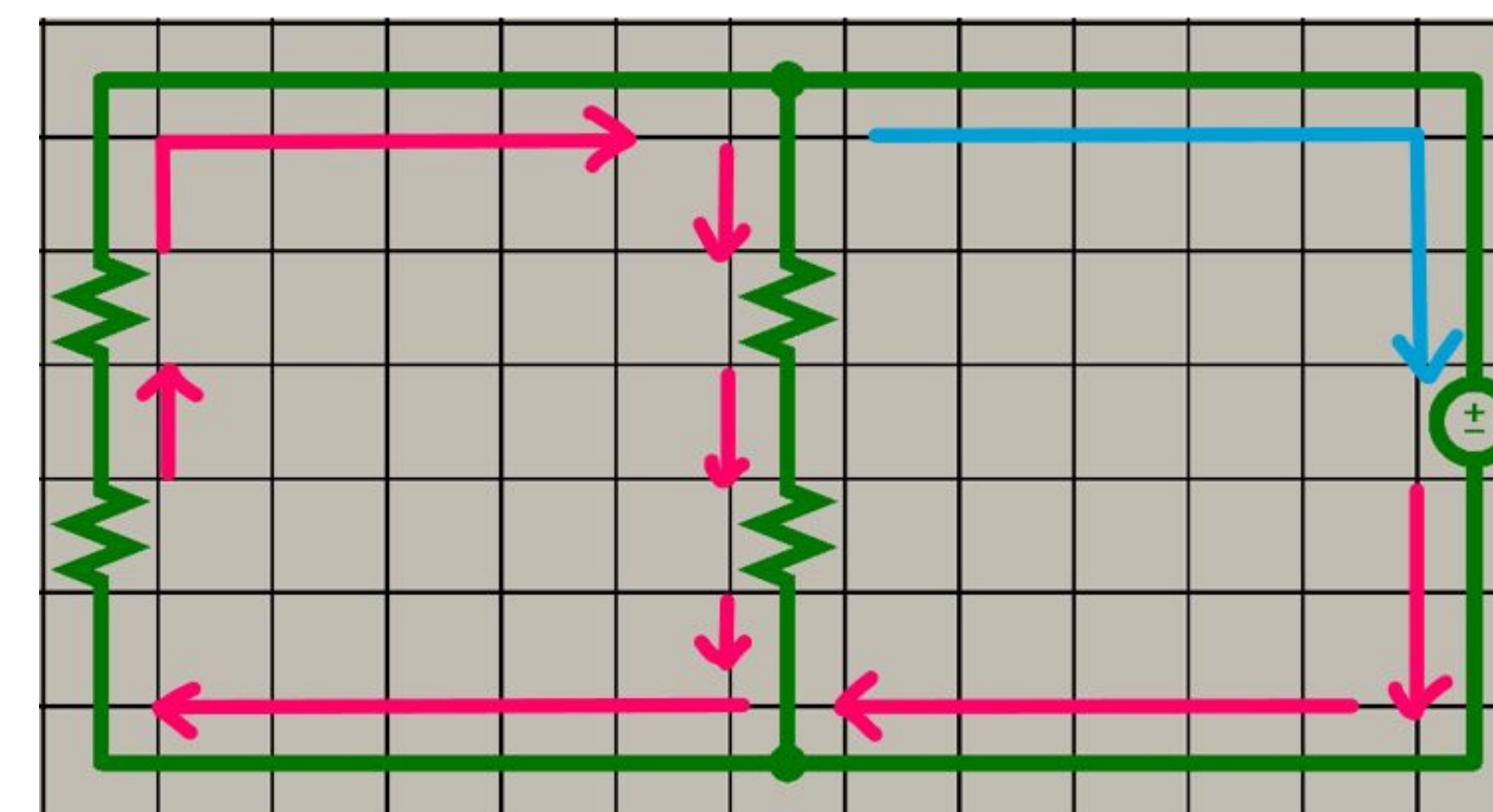


## Abstract

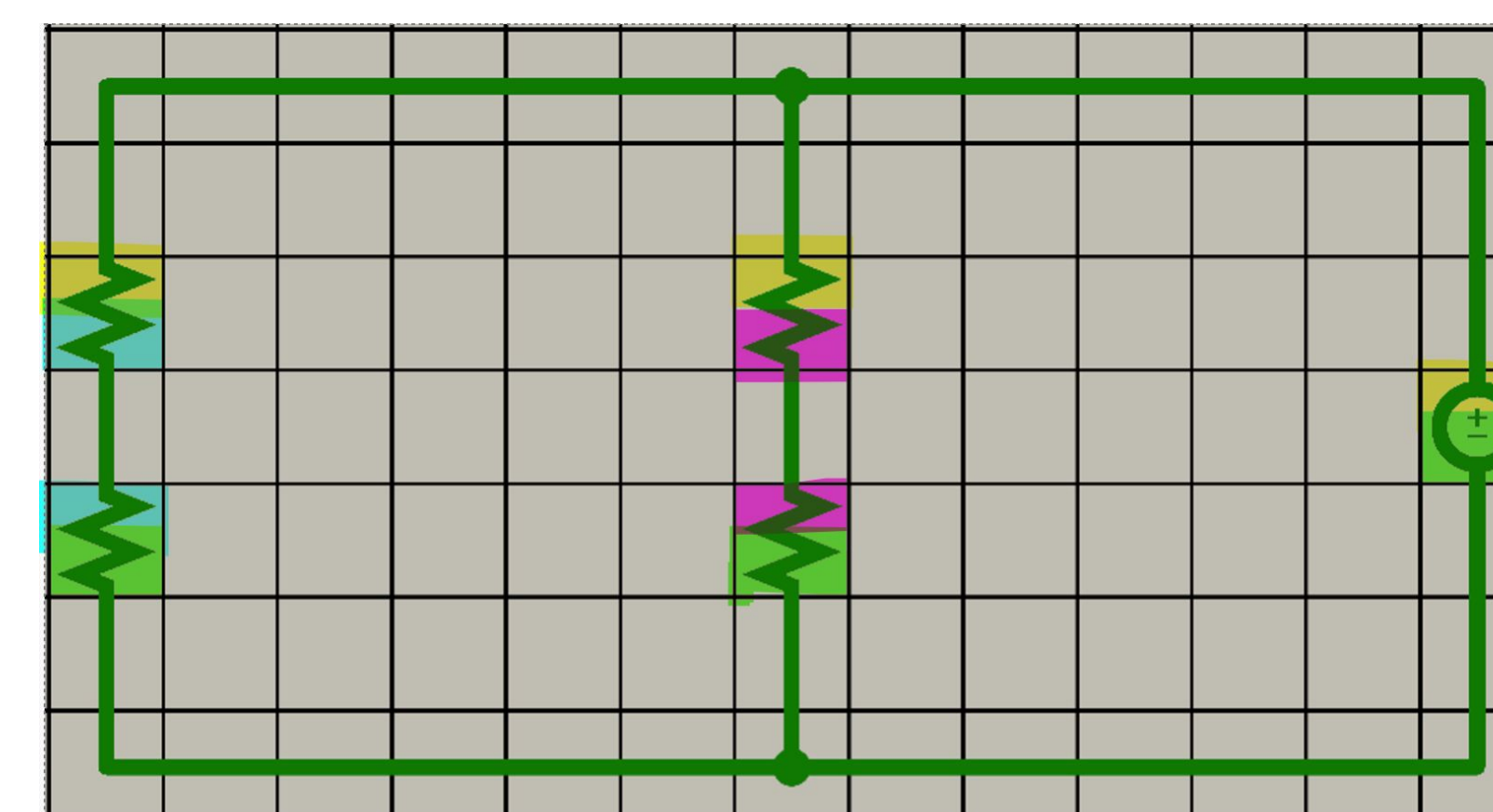
Designing circuits in electrical engineering can be a challenging and tedious task. To make the process more accessible and engaging, we have created a web-based game. The game serves as an educational tool, introducing students to circuit concepts and encouraging independent exploration. It allows users to solve pre-made circuit puzzles by finding missing values. These levels leverage Kirchhoff's current and voltage laws and help the user develop their circuit solving skills. Advanced levels will be more open ended and allow the user to make more creative solutions. Additionally, users can design their own circuits and solve for various unknowns.

## Programming

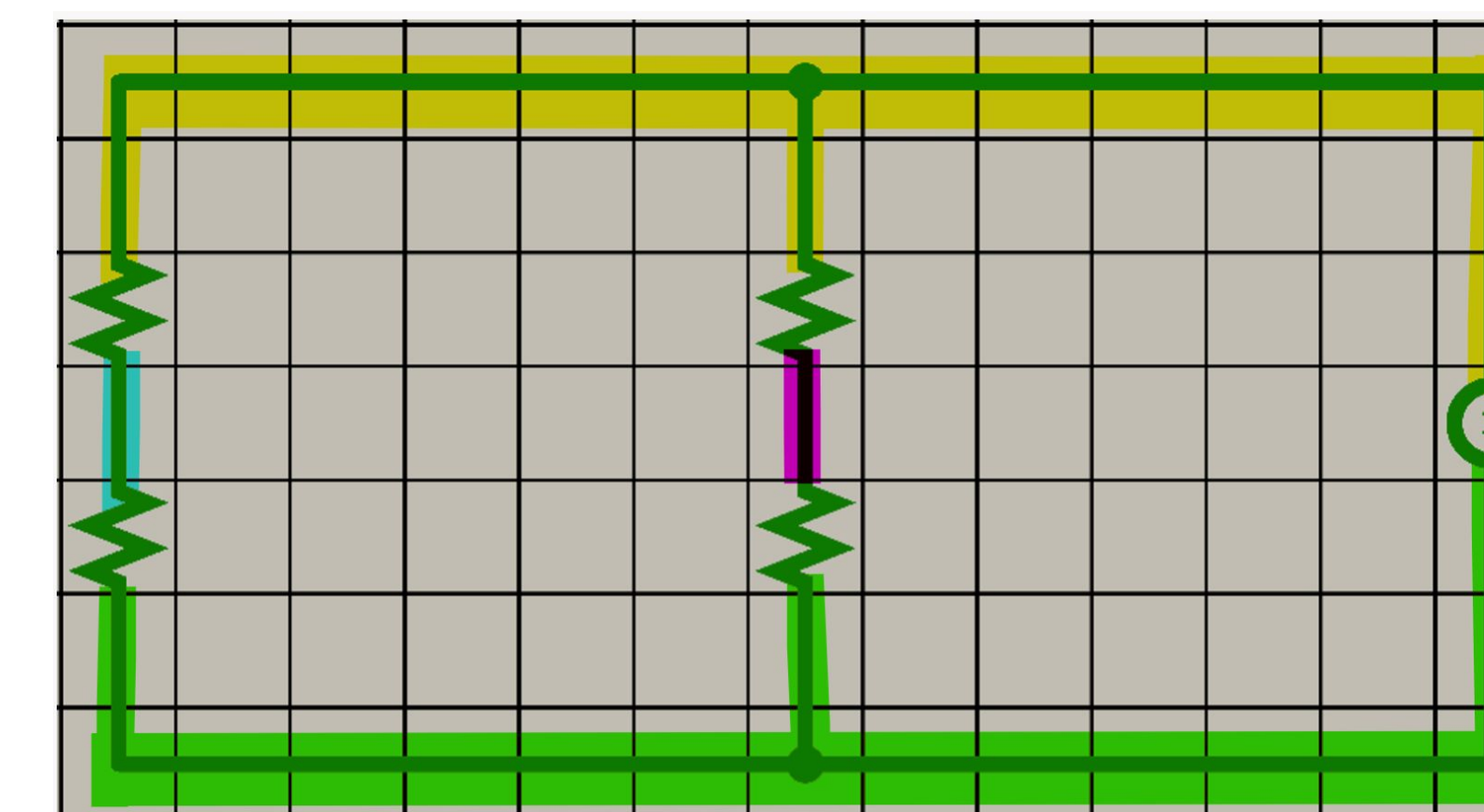
Recursive algorithms for searching circuit wires:



Components Labeled:



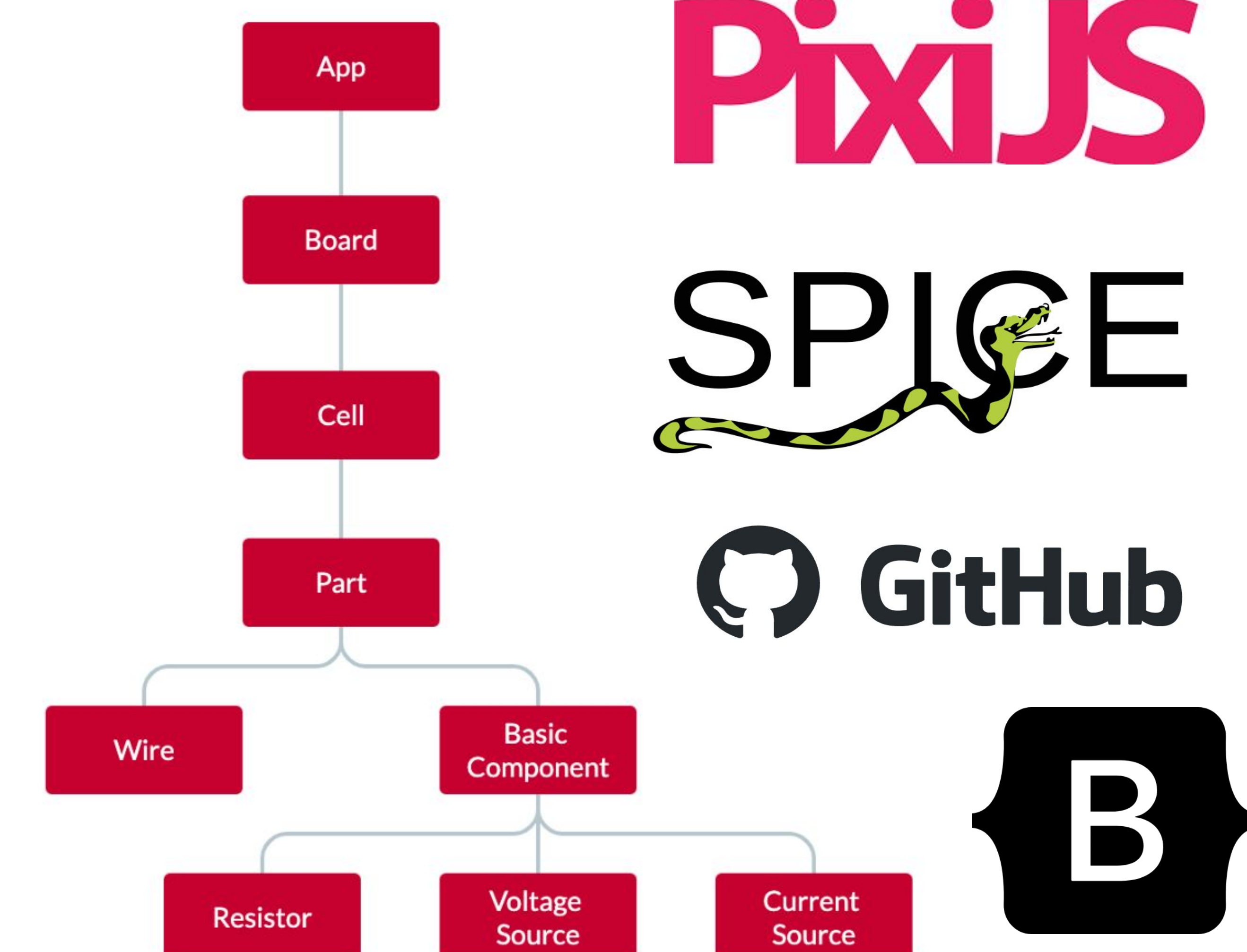
Circuit nodes identified:



Netlist Generated:

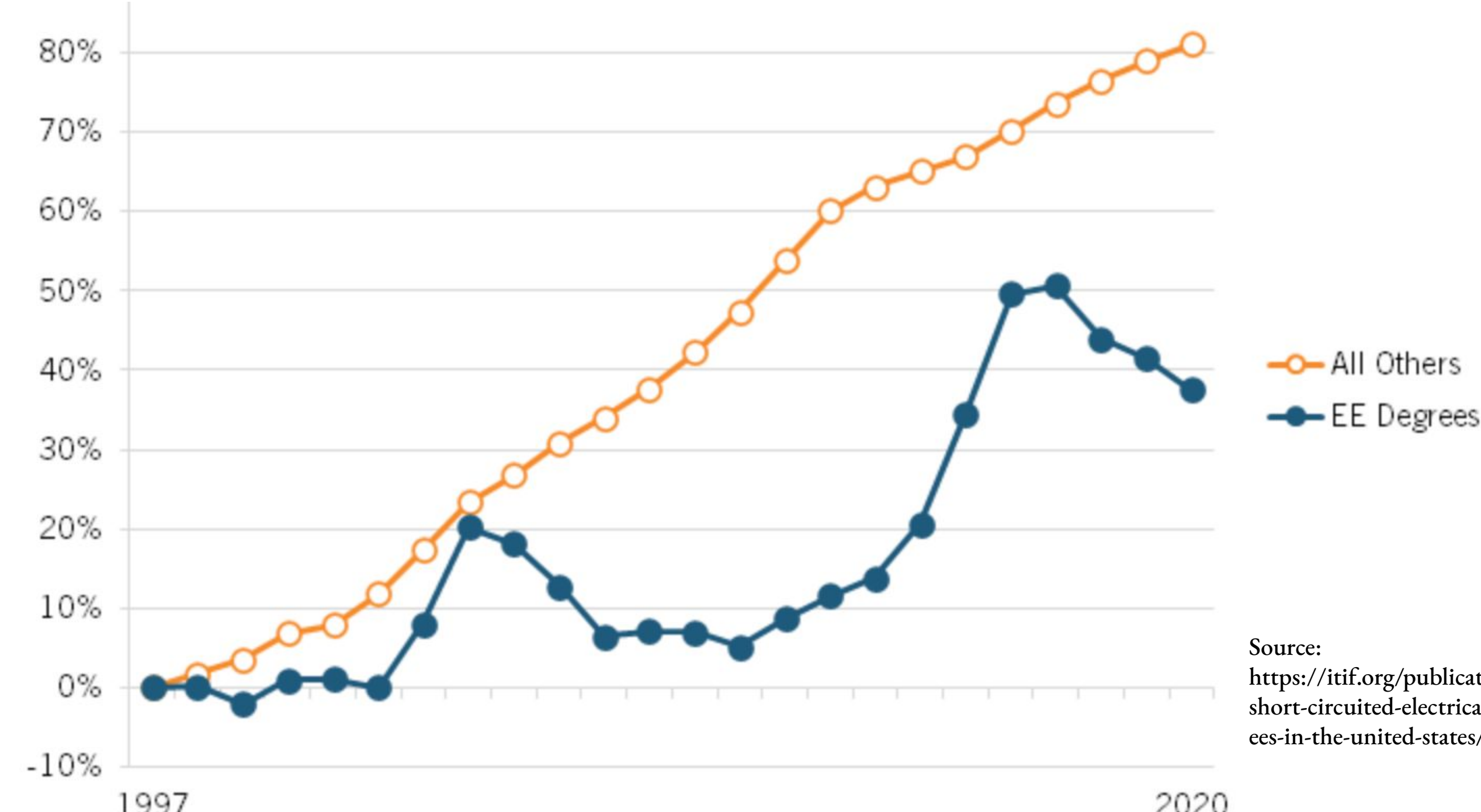
```
R1 1 2 10
R2 2 3 10
R3 3 4 10
R4 4 1 10
V1 1 3 5
```

Hierarchy of code

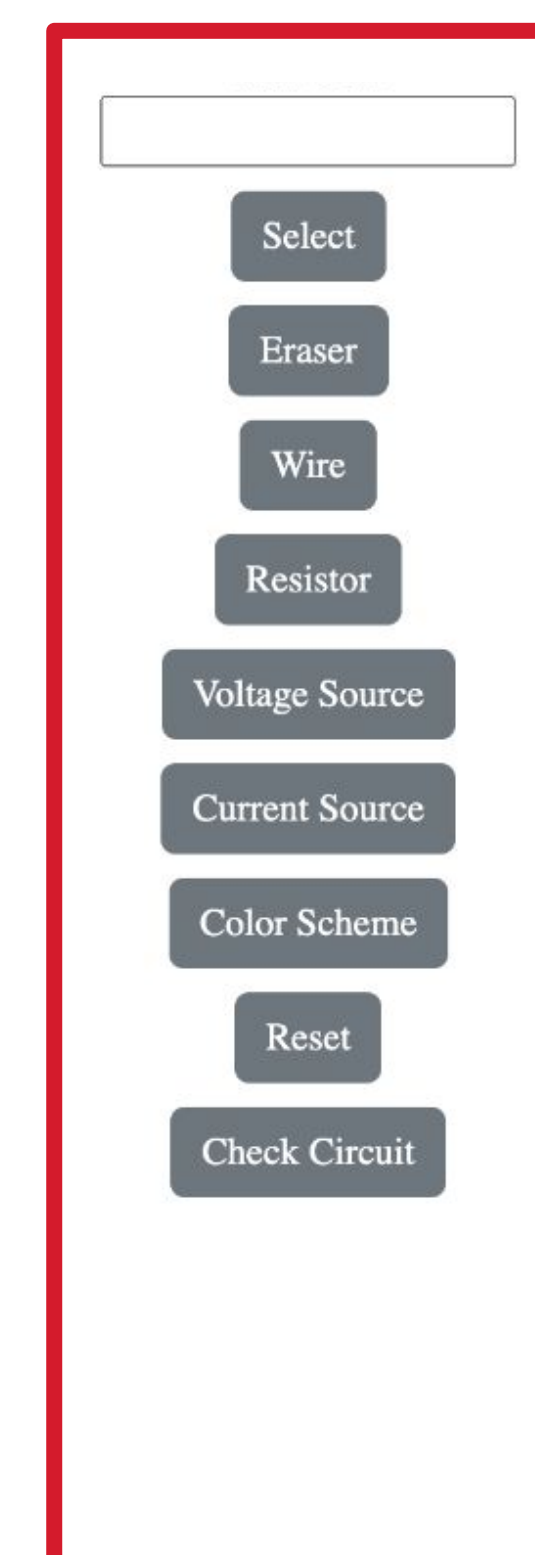


## Background

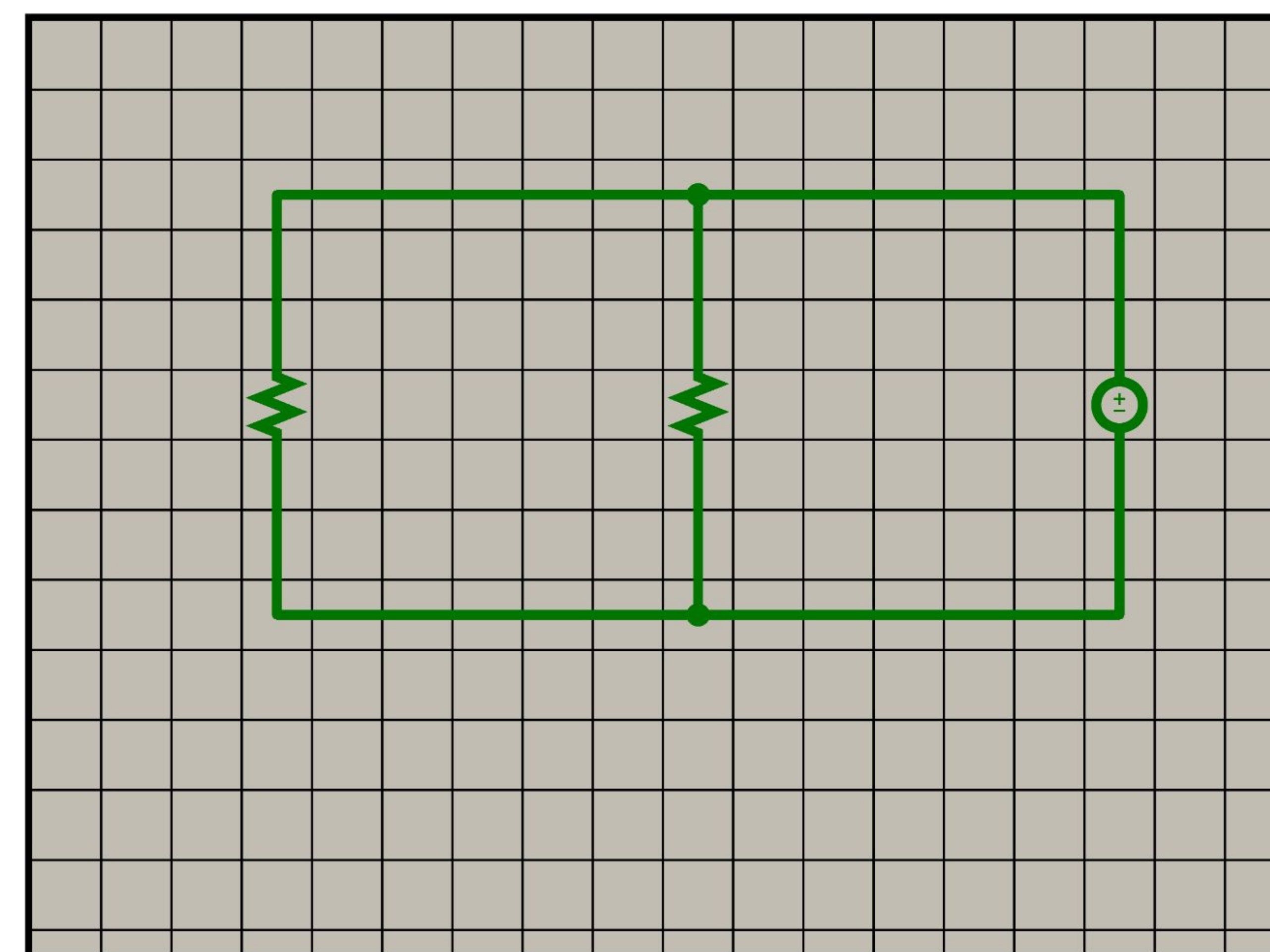
- Interest in electrical engineering has been declining
- We hope this game encourages people to study in this field and reverse the trend.
- Circuit solving is the foundation of electrical engineering, and developing circuit solving skills is critical to success.
- The basic equations needed to solve simple circuits are listed below:
- Ohm's Law:  $V = IR$
- Kirchhoff's Voltage Law:  $\sum V_i = 0$
- Kirchhoff's Current Law:  $\sum I_i = 0$



## Results



GUI controls



GUI controls include a component access buttons, a second color scheme, and reset button. Hovering over a component displays values, making solving the circuit easier and more intuitive.

This is our circuit builder and SPICE analysis tool, stay a while!



Level selection

## Conclusion and Future Steps

We are able to generate the netlist for simple circuits with current source, voltage source and resistors and solve them. The netlist creation algorithm allows for the implementation of more complicated circuit elements in the future and some next steps could include:

- More complicated circuits including inductors and capacitors
- General debugging and displaying solved values

## Acknowledgements

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