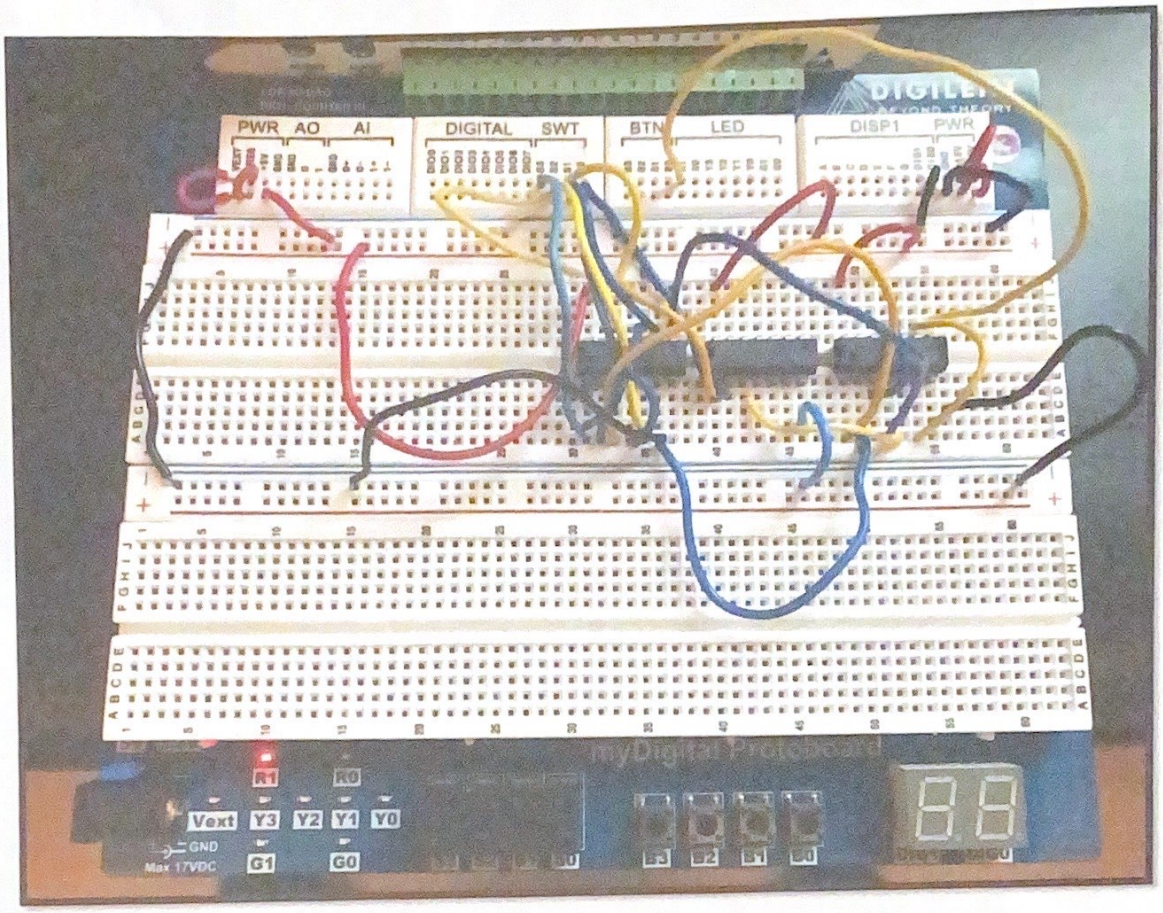
Majority Vote Project



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Introduction

In this activity, students learned the method of simplifying long and complicated Boolean expressions, building the circuit on a virtual simulated program and building the circuit on a physical breadboard. The purpose was to identify the votes that counted as yes or no.

Material

Description	Part Number	Quantity
Breadboard	N/A	1
AND Gate	74LS32N	1
OR Gate	74LS08N	2
Wires	N/A	15+
Multisim	v14.0	1
myDAQ	800949B-01	1

Design Brief

Client- LightningBob Co.

Target Consumer- The board of directors

Designer – Keyur Rana

Problem Statement – The use of paper ballots resulted in an unacceptable amount of over-votes and under-vote

Design Statement – To design, build and test an electronic voting machine

Constraint –

- Only use 2-input AND gates, 2 input OR gates and inverter
- Use Boolean algebra
- Use switches for input
- In events of a tie, the president vote is used to break the tie.

Evidence of Analysis – Truth Table

P	V	S	T	D
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

This is the midterm of the truth table shown above:

P'VST+PV'S'T+PV'ST'+PV'ST+PVS'T'+PVS'T+PVST'+PVST

P = President

V = Vice President

S = Secretary

T = Treasurer

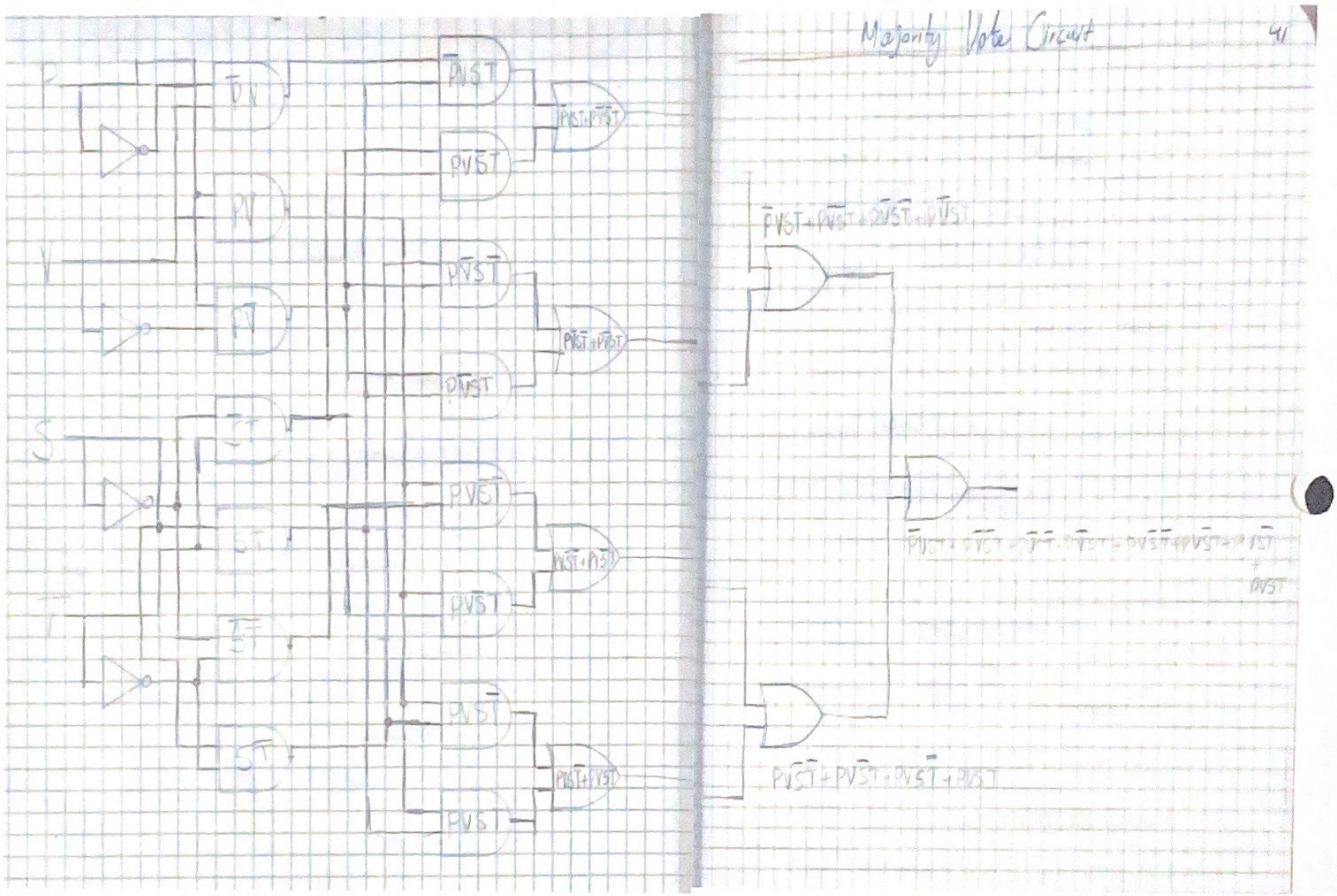
D = Decision

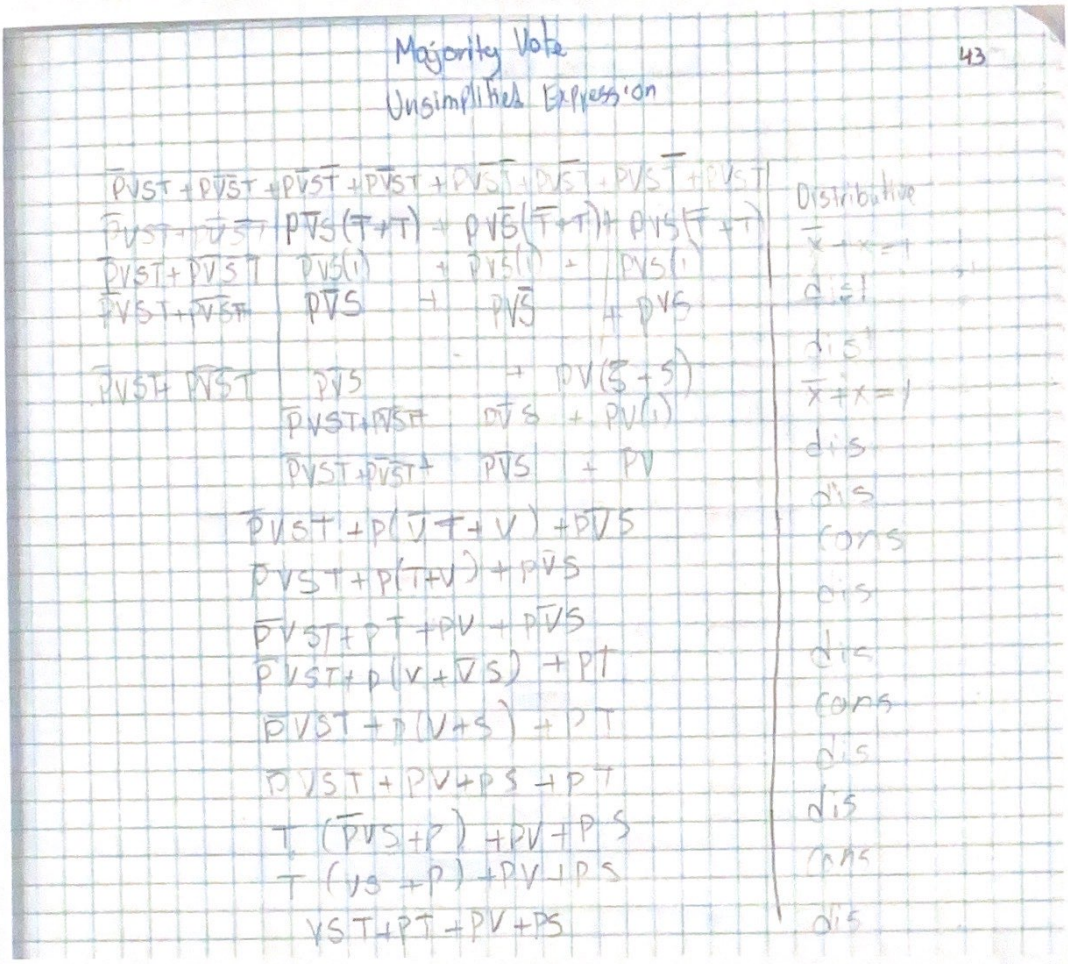
1 = Yes or decision made

0 = No or decision not made

Evidence of Working Design – Sketch of Circuits (Unsimplified)

Unsimplifed circuit that we drew on our Engineering Notebook.



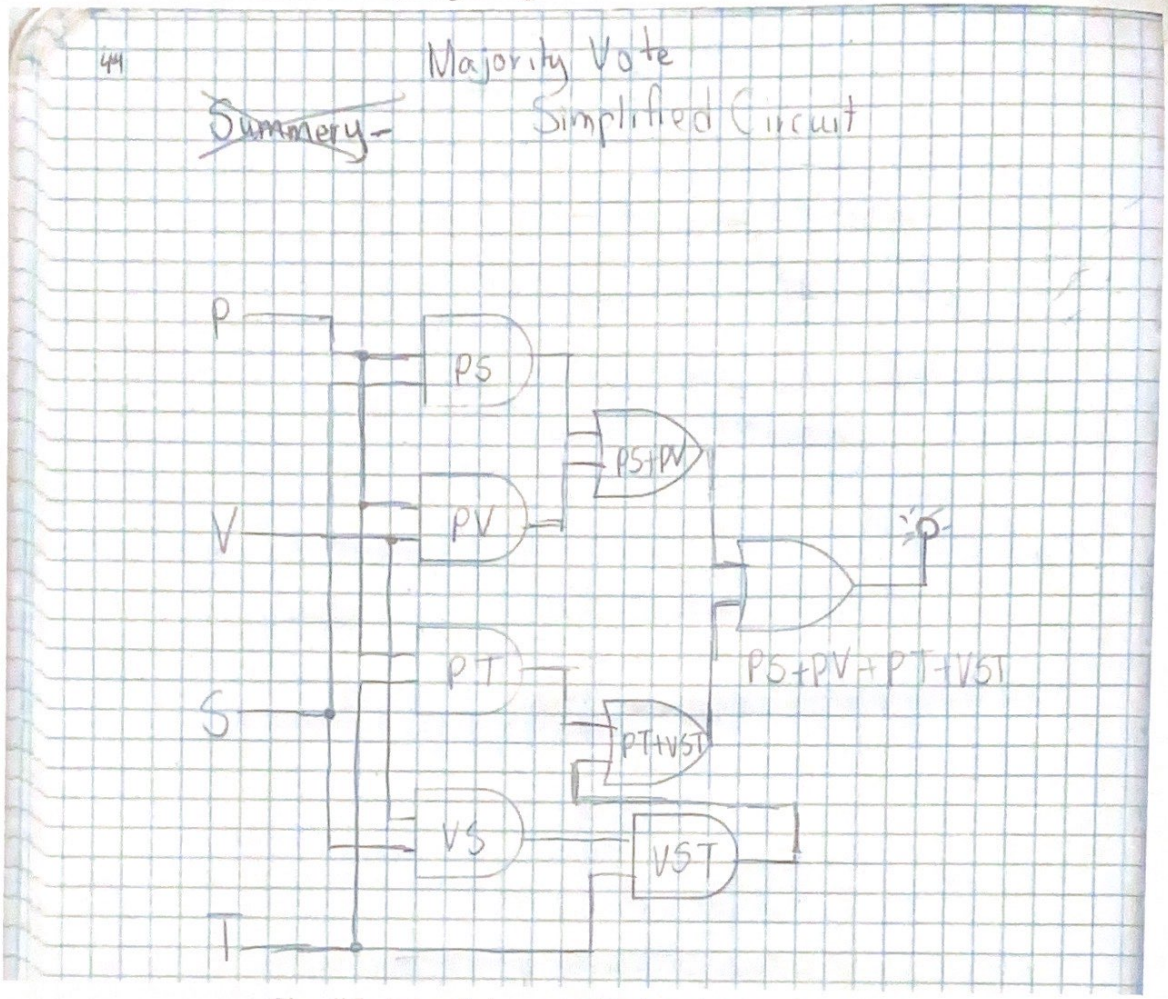


Boolean algebra that was needed to make the circuit smaller and simpler to understand

Evide

Unsimpli

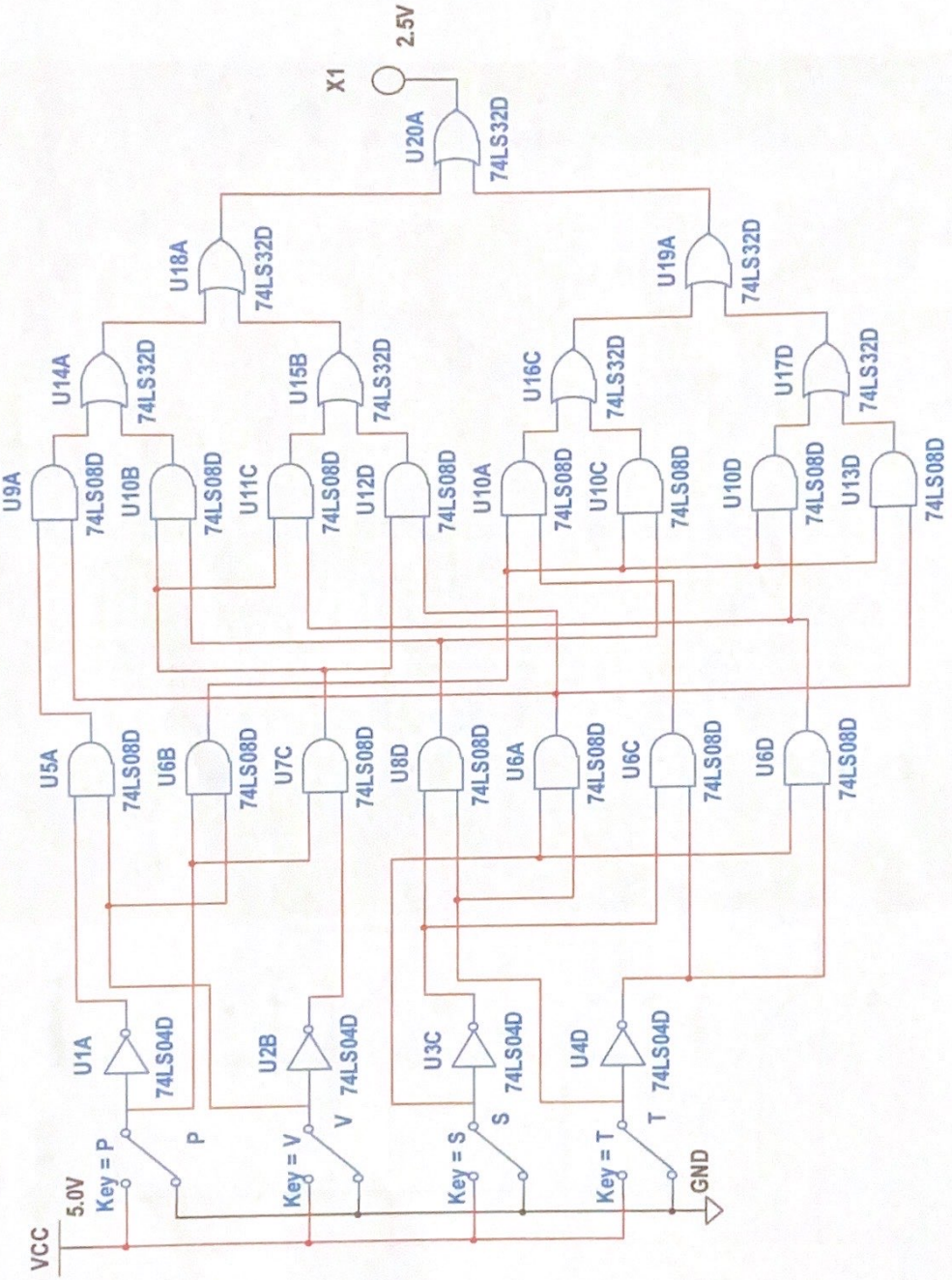
Evidence of Working Design – Sketch of Circuits (Simplified)



Simplified circuit drawn on Engineering Notebook

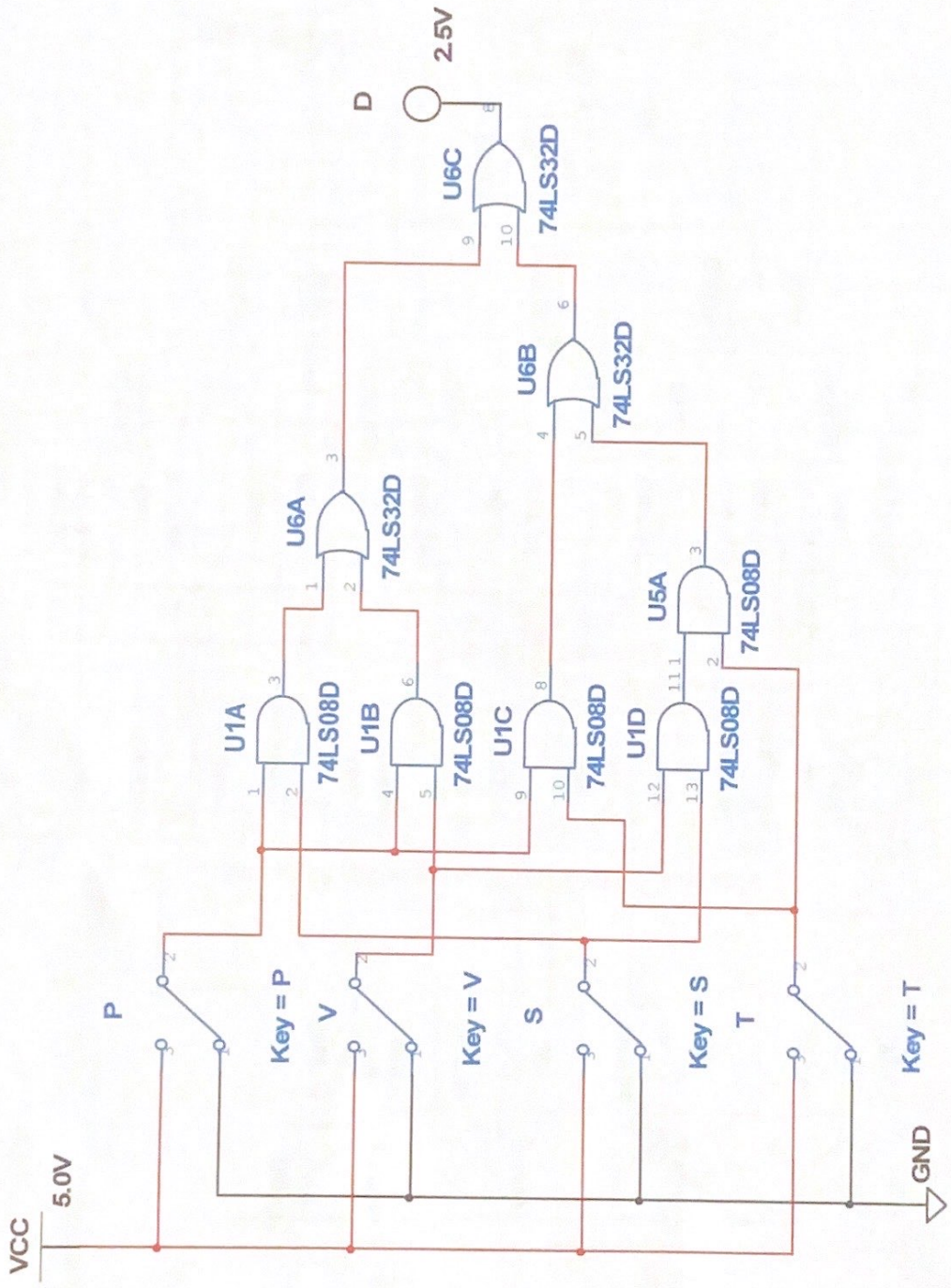
Evidence of Working Design – Computer Simulated Circuit (Simplified and Unsimplified)

Unsimplified -



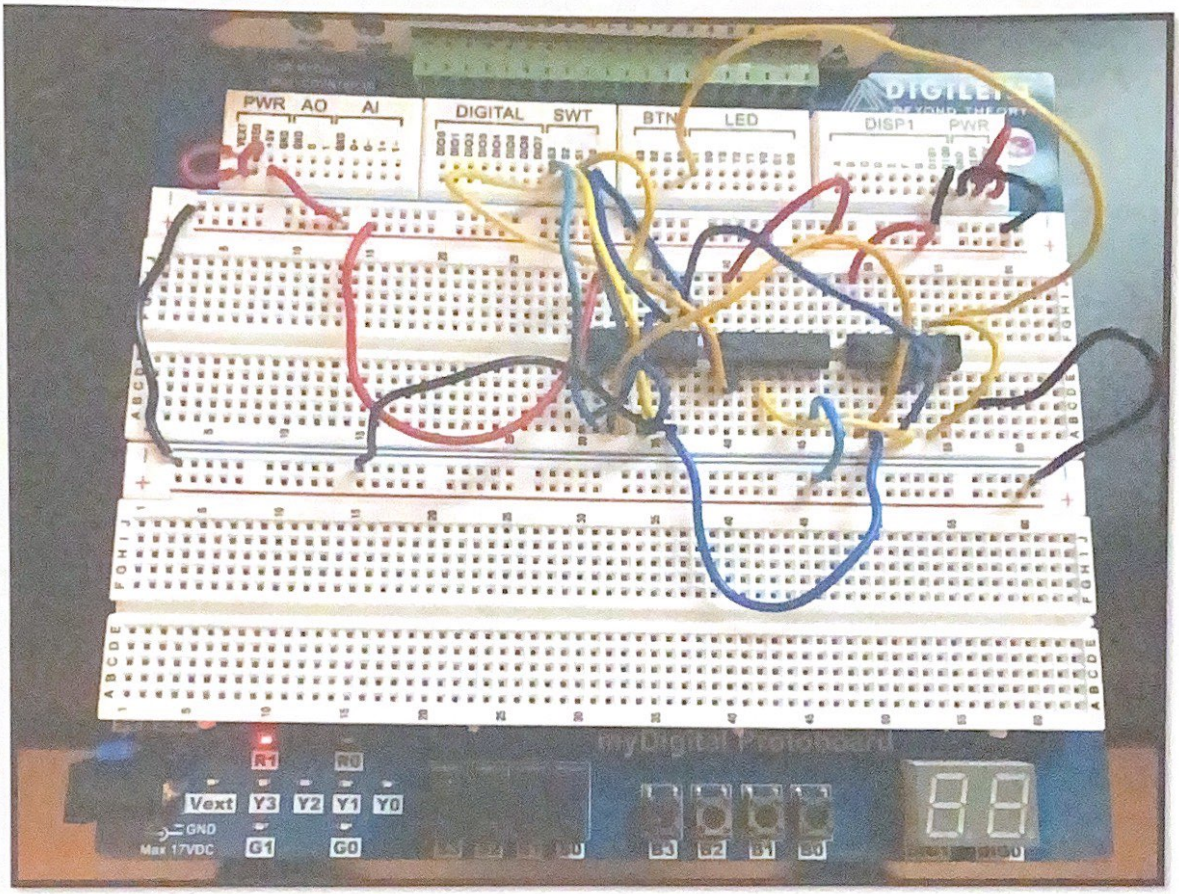
Unsimplified circuit that was built on Multisim that used a lot of Logic Gates.

Simplified -



Simplified circuit built on Multisim that used less logic gates.

Evidence of Working Design – Breadboard Circuit



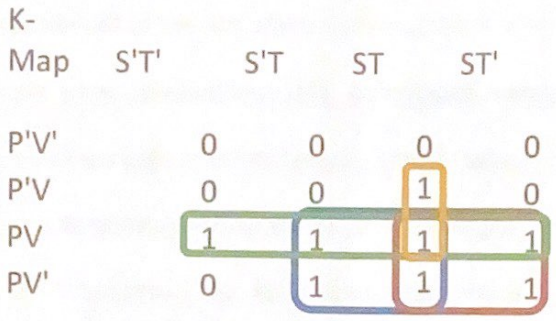
Actual simplified circuit built on a breadboard hooked up to a myDAQ.

Conclusion

In this project, we were to design, build and test an electronic voting machine to fix the use of paper ballots resulting in an unacceptable amount of over-votes and under-votes. First we needed to understand the problem, so we made a truth table and dividing each midterms which are P for president, V for vice president, S for secretary and T for treasurer. We used binary to represent weather the decision was made (1) or not (0). We also had decision that determined if three of these agreed, the decision would be made which would represent a 1. In any event of a tie, the president vote was used to break the tie. The constraints in this project was to use only 2-input AND gates and 2-input OR gates and Inverters. After we had made our truth table, we made a unsimplified Boolean expression of the midterms. We drew the circuit on our Engineering Notebook. We then built the circuit on a simulated software called Multisim, this allowed us to check for errors before building it on an actual breadboard. The unsimplified circuit was complex. It was really big that it needed to be fit on a size B paper. It had to be shortened down. It used 4 OR gate ICs, 2 AND gate ICs and 1 Inverter ICs. This was a lot, and could possibly cost the company a lot of money. We simplified the circuit by using Boolean algebra Theorems and laws. This significant change was very crucial. After we had simplified the circuit, we drew it on our Engineering notebook and then built it on Multisim again to check for errors. After we made sure that the circuit was working on Multisim, we then started constructing the simplified circuit on a breadboard that was connected up with myDAQ to a computer. We had a lot of struggles with the circuits because we were fairly new to it and the ICs and the wires would tend to pop out a lot but we came around it and managed to use it and make it work. We had completed our circuit of Majority vote. Where if three people or more voted, a

decision was made, and if two people agreed and other two people disagreed, president vote was used to break the tie and would output a 1 which was decision made. This project made us realize how important it is to make less errors when working with circuits and not to fool around as it could cause errors when building the circuit on a breadboard. This problem was really well made and it was something that was related to the actual world. Engineers are problem solvers and this was one of the fun projects we really enjoyed to do. Yes, we had difficult times at understanding the Boolean algebra and using it to solve a real life problem but it was really worth it at the end. It was fascinating to see a circuit that you made with your own hands and I would love to do these kinds of project in future.

Appendix



Vote = PS+PV+PT+VST

K-Mapping is an alternative graphical method used to simplify long minterms. Instead of simplifying long minterms using the Boolean Algebra method, one step at a time, K-Mapping makes it faster and easier to simplify, and less work. Used binary to represent the minterms. 0s representing off and 1s representing on.