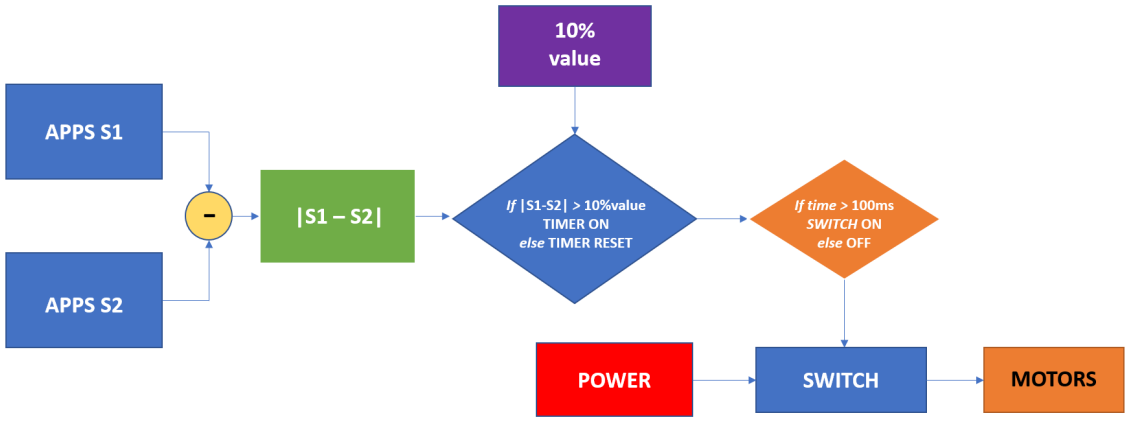
HARDWARE REQUIRED :

- OP-AMPs
- Resistors
- Capacitors
- Voltage-controlled switch i.e MOSFET (note: need something which needs to be mechanically reset after being switched off)
- Buffers
- Relay
- APP sensor of potentiometer type.

ALGORITHM FOLLOWED :



APPS SENSOR AND HOW THEY WILL BE CALIBRATED :

For the APPS sensor to be used we calibrated the two sensors as followed :

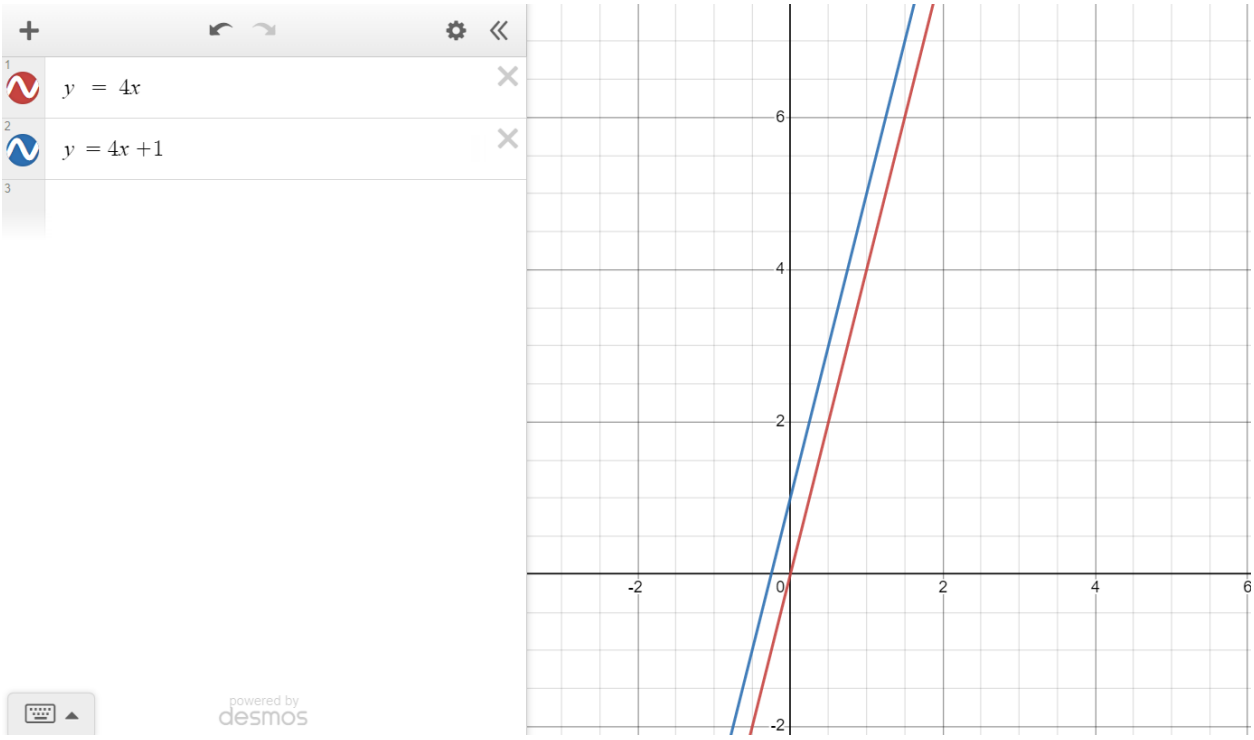
1) Range : 0 - 4 V (corresponding to 0% to 100 %)

2) Range : 1 - 5 V (corresponding to 0% to 100%)

Assuming the nature of the sensors to be linear, the equations for the two sensors can be given by :

1) Y1 = X1/25
2) Y2 = X2/25 + 1

Y = sensor output voltage , X = pedal position of accelerator

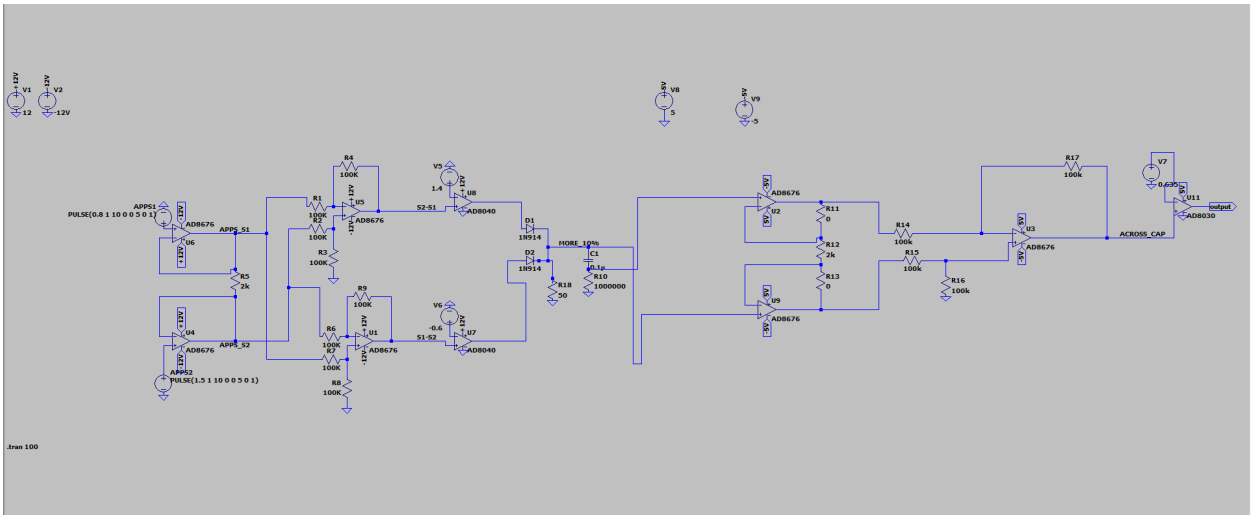


As we can see, these are two non intersecting functions.

Also in case of short-circuit between the two sensors, the difference between X1 & X2 will be 25%, which qualifies for

implausibility. In the case of X1 - X2 > 10% , we get Y1-Y2 > -0.6 V and for X2 -X1 > 10% , we get Y2 -Y1 > 1.4 V.

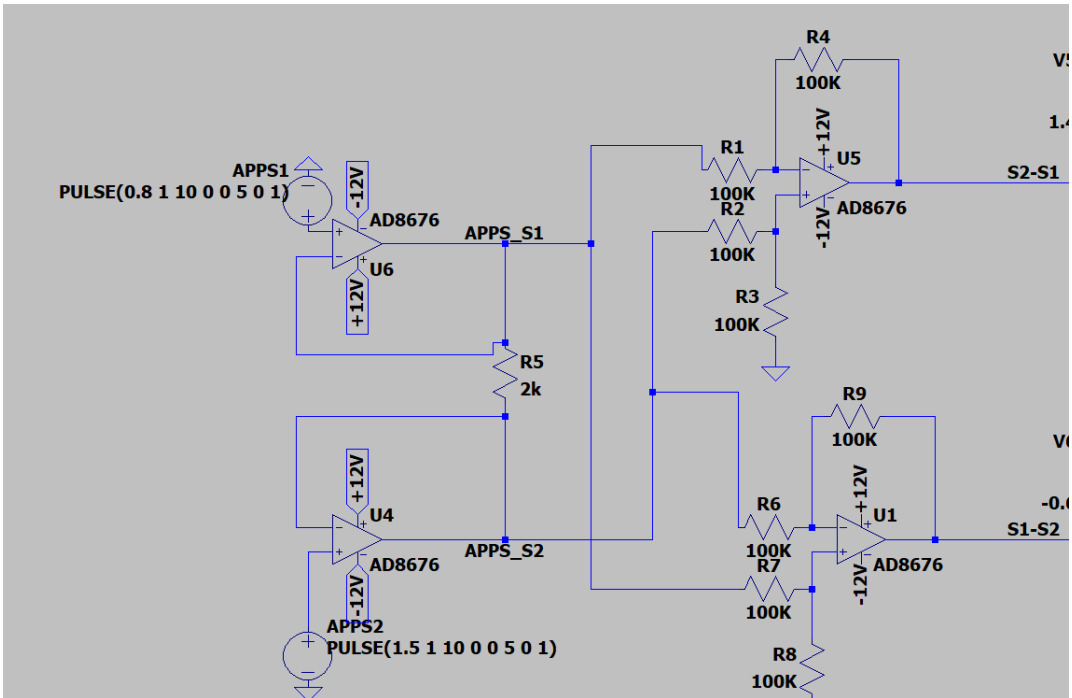
FINAL CIRCUIT :



The circuit can divided into two separate parts based on the function each part performs :

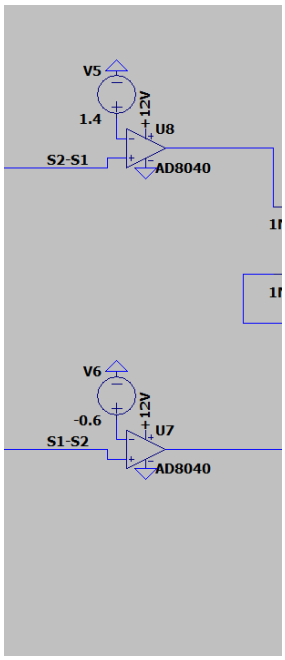
A) The first part sends a High(8 V) or a Low(0 V) signal depending upon the implausibility condition of the 10% pedal position difference.

The difference between the APPS sensor signals can be found using an ***instrumentation amplifier circuit*** as shown below:

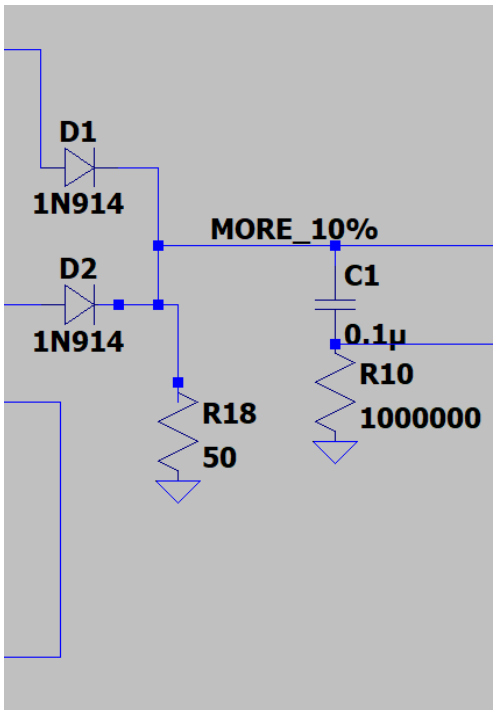


Here we find out ***S1-S2*** and ***S2-S1,*** each of which will be checked for the implausibility condition.

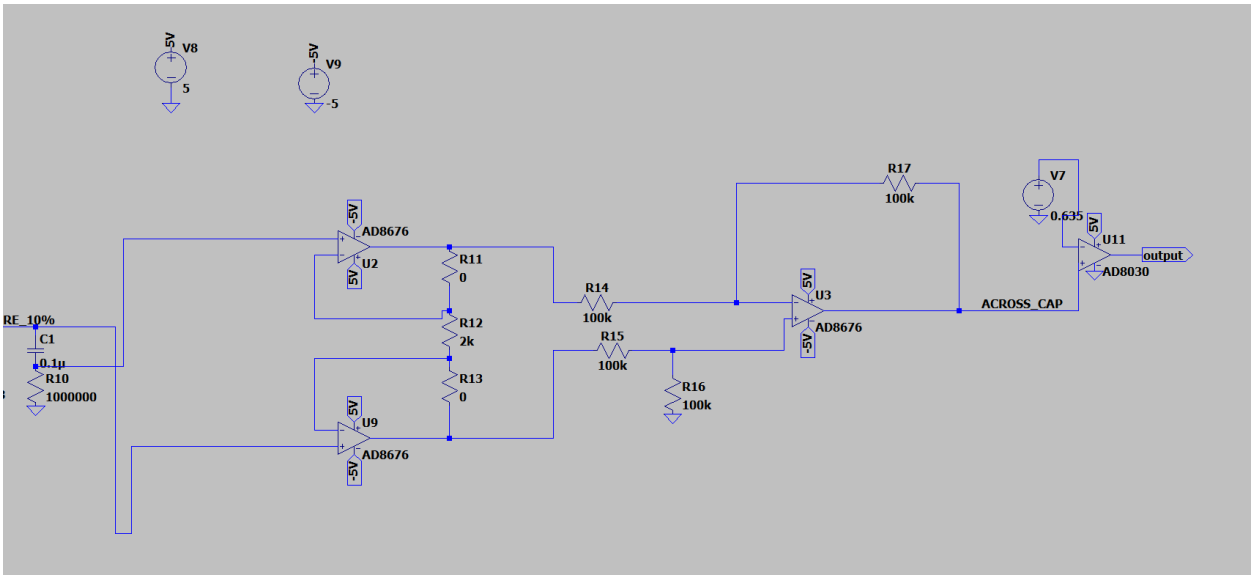
Both **S1-S2** and **S2-S1,** are checked against set voltages above which they are sure have a case of implausibility.



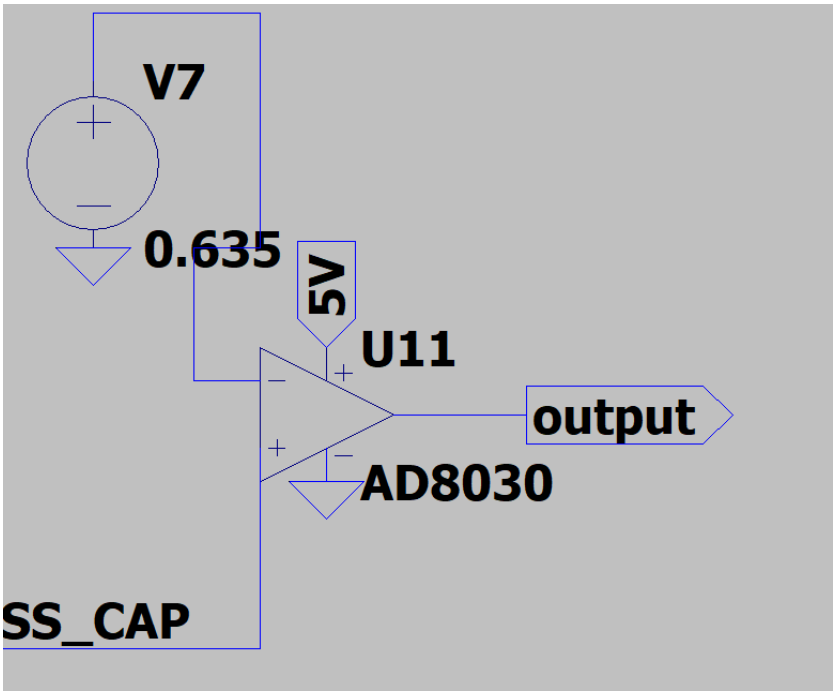
Then DTL OR circuit which detects the implausibility correctly and passes on about 8 V to the RC circuit ahead.



B) This part checks if the implausibility lasts longer than 100ms or not.

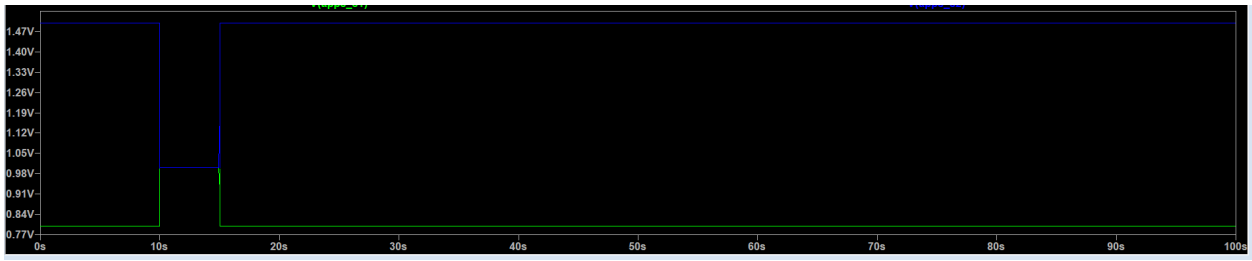


The output from the Part A block of the circuit will be applied to the RC circuit shown, if the output is high i.e there was a case of implausibility then the capacitor begins to charge. The output from the Part A block of the circuit will be applied to the RC circuit shown, if the output is high i.e there was a case of implausibility then the capacitor begins to charge. After this we use a comparator to probe the voltage across the capacitor such that as soon as it crosses the voltage calculated by ,across it at 100 ms, a high voltage signal is sent as the output of the entire circuit.

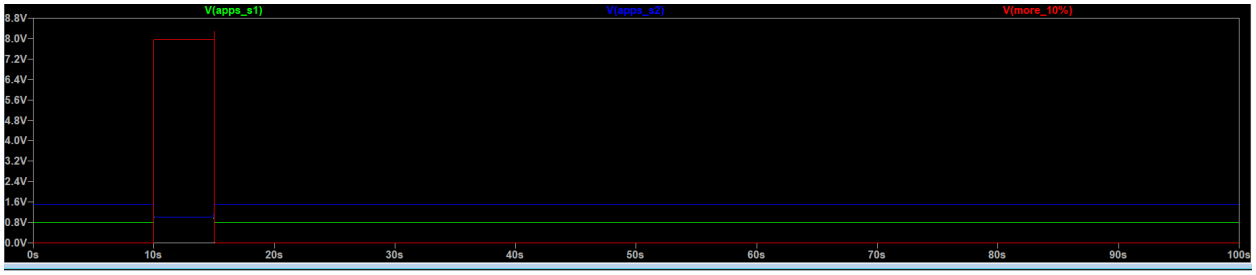


Example to demonstrate :

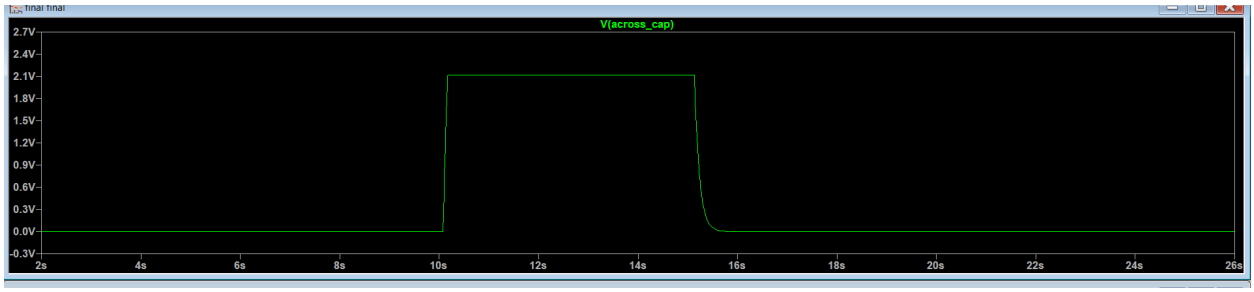
Here we see the signals from the two APP sensors ; they give the same value from t =10s to t = 15s, which qualifies for implausibility .



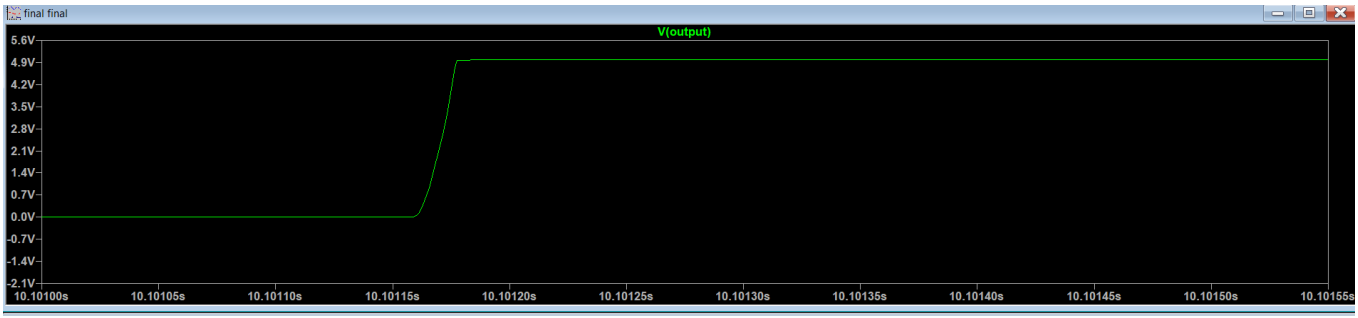
Then we observe the corresponding signal generated for the occurrence of implausibility which occurs in the same time frame . The magnitude of the signal being V = 8 v.



Correspondingly, the capacitor begins to charge and its voltage profile is as shown.

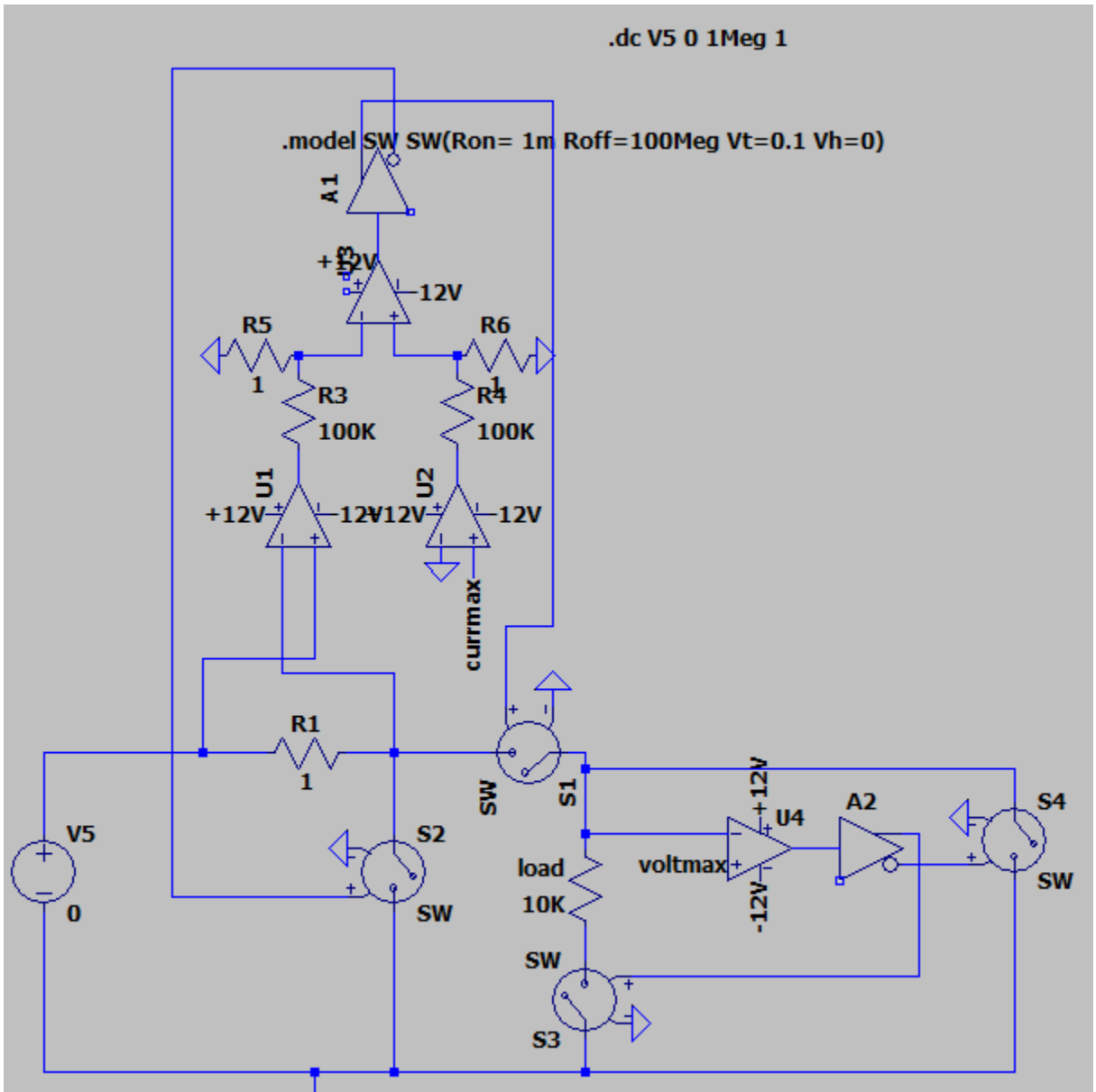


And as soon as we are sure that the implausibility lasts more than 100 ms we generate the output. The output impulse reaches its peak value of 5V at t = 10.10117 s.



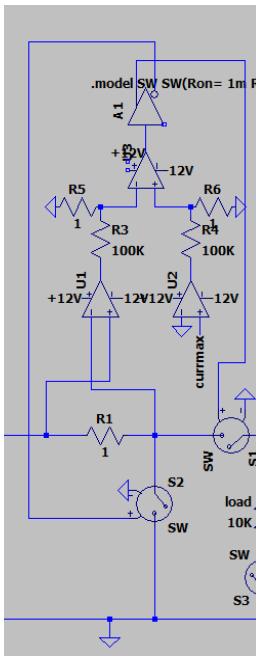
CHECKING FOR CURRENT AND VOLTAGE IMPLAUSIBILITY AFTER CONNECTION WITH MOTOR

Once the connection is made between power and motors, we should check for sudden power surges in voltage and current. For that we have designed the circuit given below:



This circuit consists of two parts:

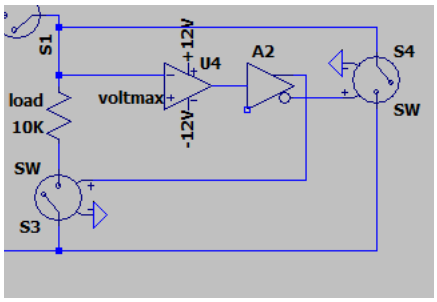
- **CURRENT CHECK**



We add a ***1 ohm*** resistor in series with the main load and compare the voltage drop across the resistor with a maximum allowed voltage drop using a comparator circuit.

If the voltage drop is less than the max value then, the power is supplied to the motors, else the supply is shorted to Ground.

- **VOLTAGE CHECK**



We check the voltage across the load (motors) and compare it with the max allowable value using a comparator circuit.If the voltage across

the motors is desirable, the power is supplied as usual, else the voltage is shorted to Ground.