

ANALOG WALL FOLLOWING ROBOT

TEAM EVOKE



INTRODUCTION

We chose to build a simple wall-following robot using analog electronic components. We measure the distance from the robot to the side walls using sharp IR sensors. Then using a PID control circuit, we generate a signal so that the robot tracks and travels on the centerline between the walls.

COMPONENTS

10 TL084CN ICs -JFET 14 pin ICs with 4 OpAmps

- Gain is maximum at low frequencies. Gain decreases after 20Hz.
- Quad opamp IC is used since our circuit includes 28 opamps.
- Dual power supply IC- higher stability.
- High CMRR (86dB) IC- less effects from noise

2 Sharp IR sensors-

- measure distance from robot to wall
- only available distance measuring sensor which produces an analog signal.
- range- 2-60cm ideal measurable distance

COMPONENTS

2 N20 motors-

- more accurate than plastic motors- for plastic motors even though the same voltage is applied rpm values differ
- low power consumption

L298 motor controller-

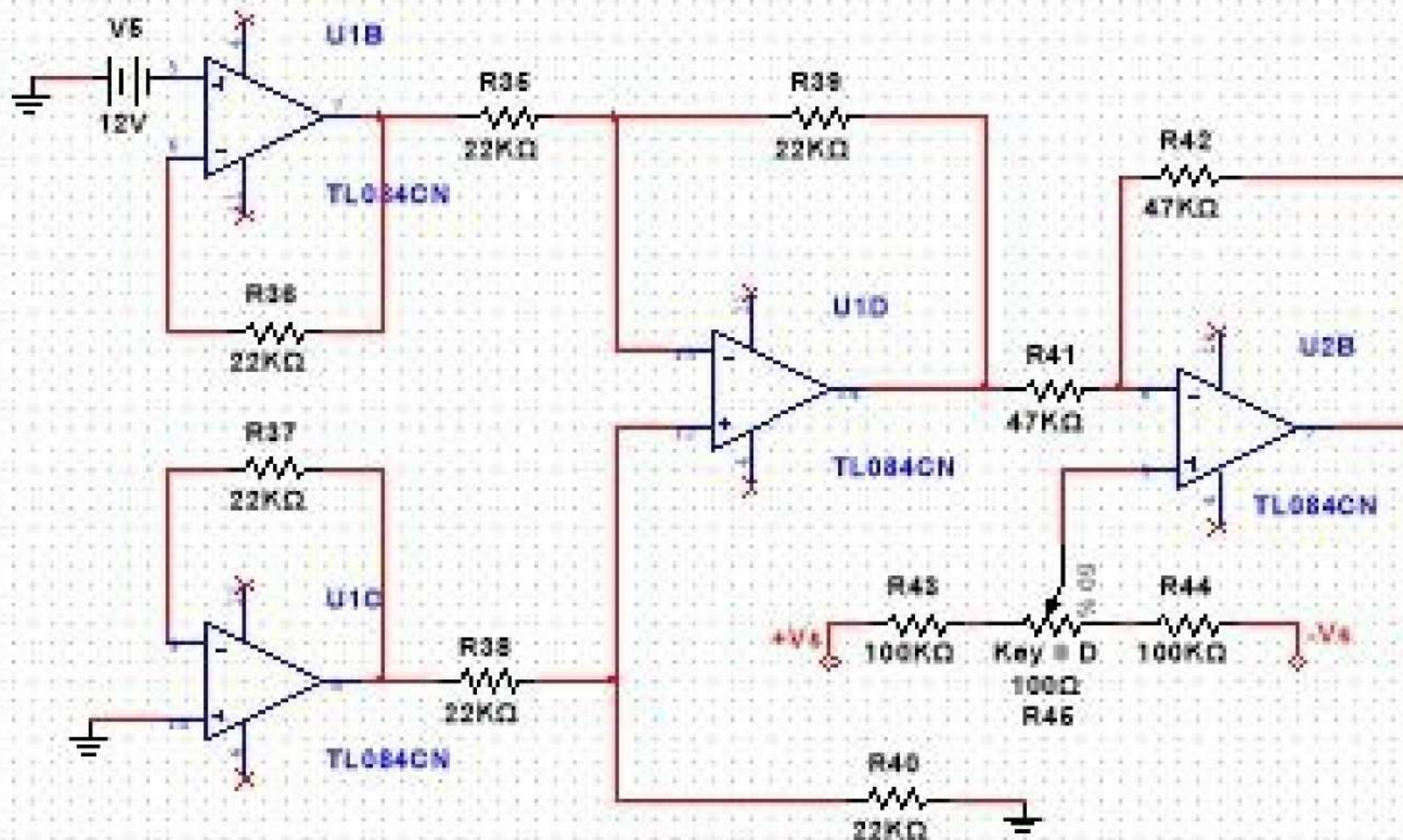
- To control both motors simultaneously

Wheels-

- Two rubber wheels and a caster wheel is used

CIRCUITS -Instrumentation Amplifier

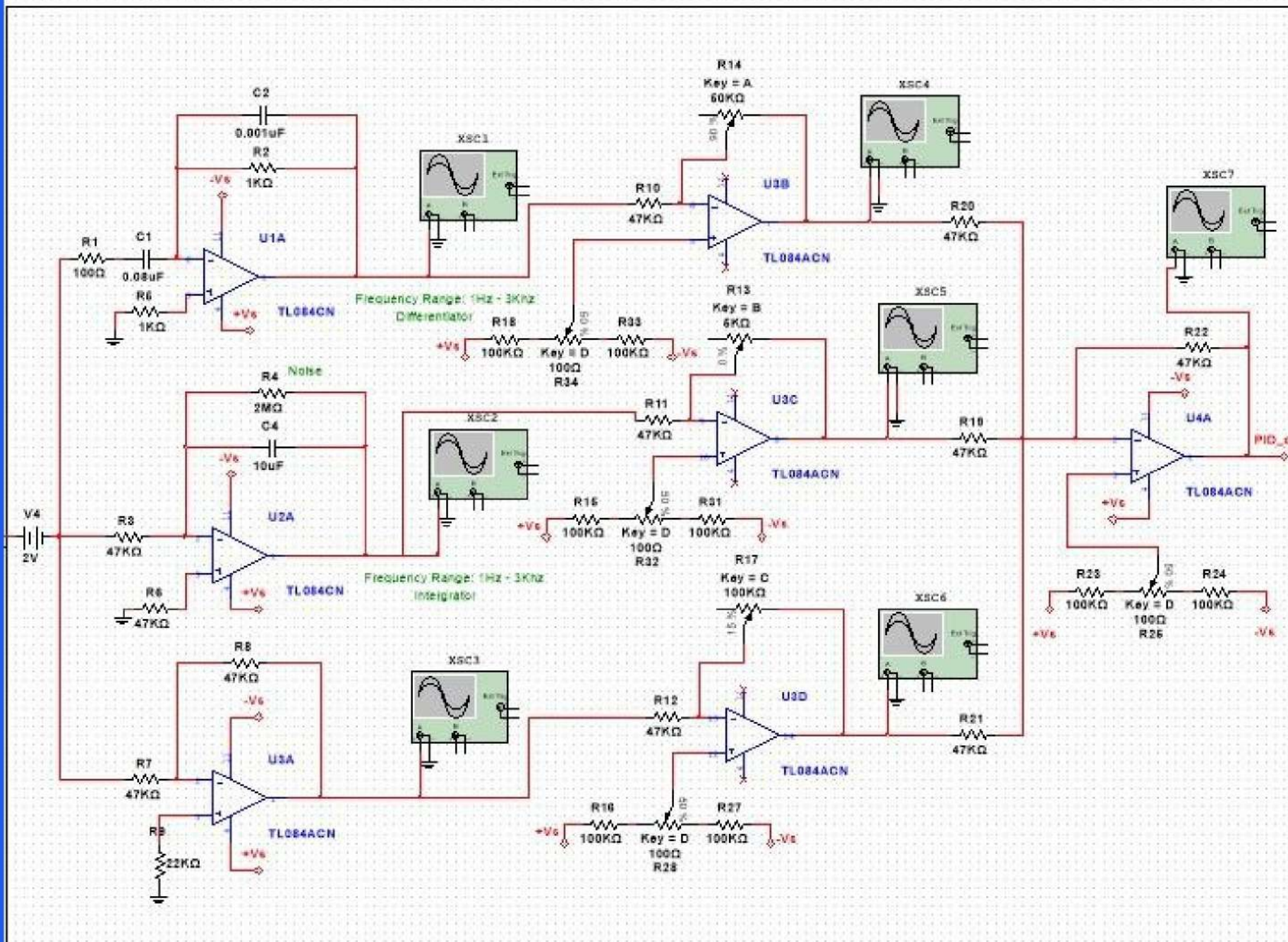
Instrumentation Amplifier



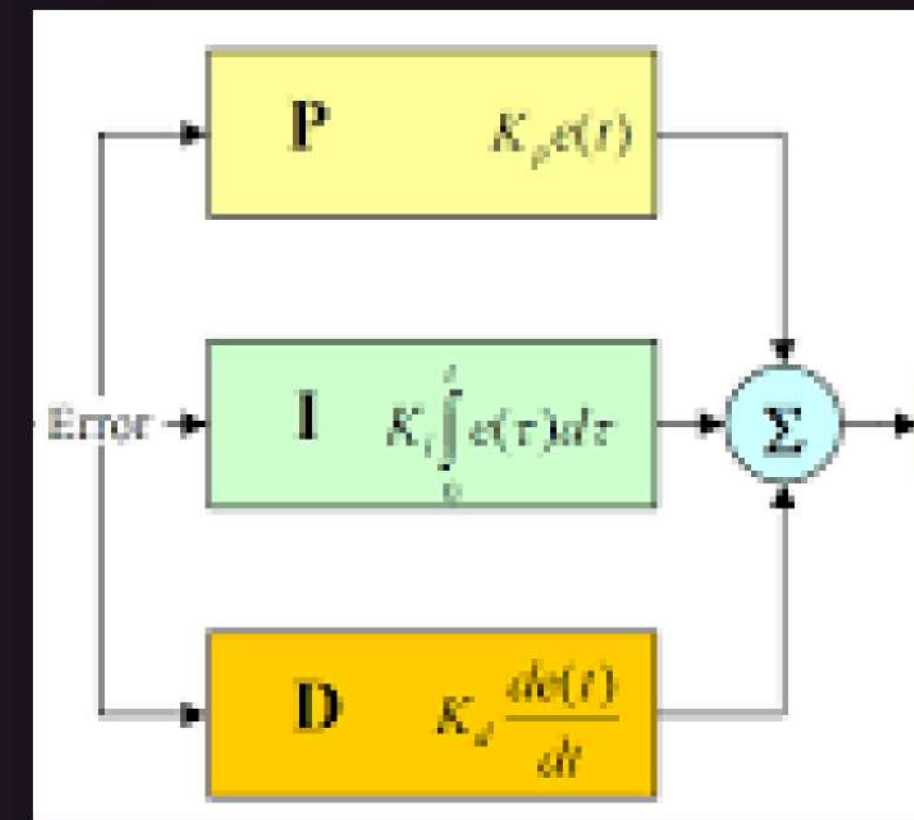
Reduce noise in sharp IR sensor outputs and amplify

CIRCUITS - PID

PID Circuit

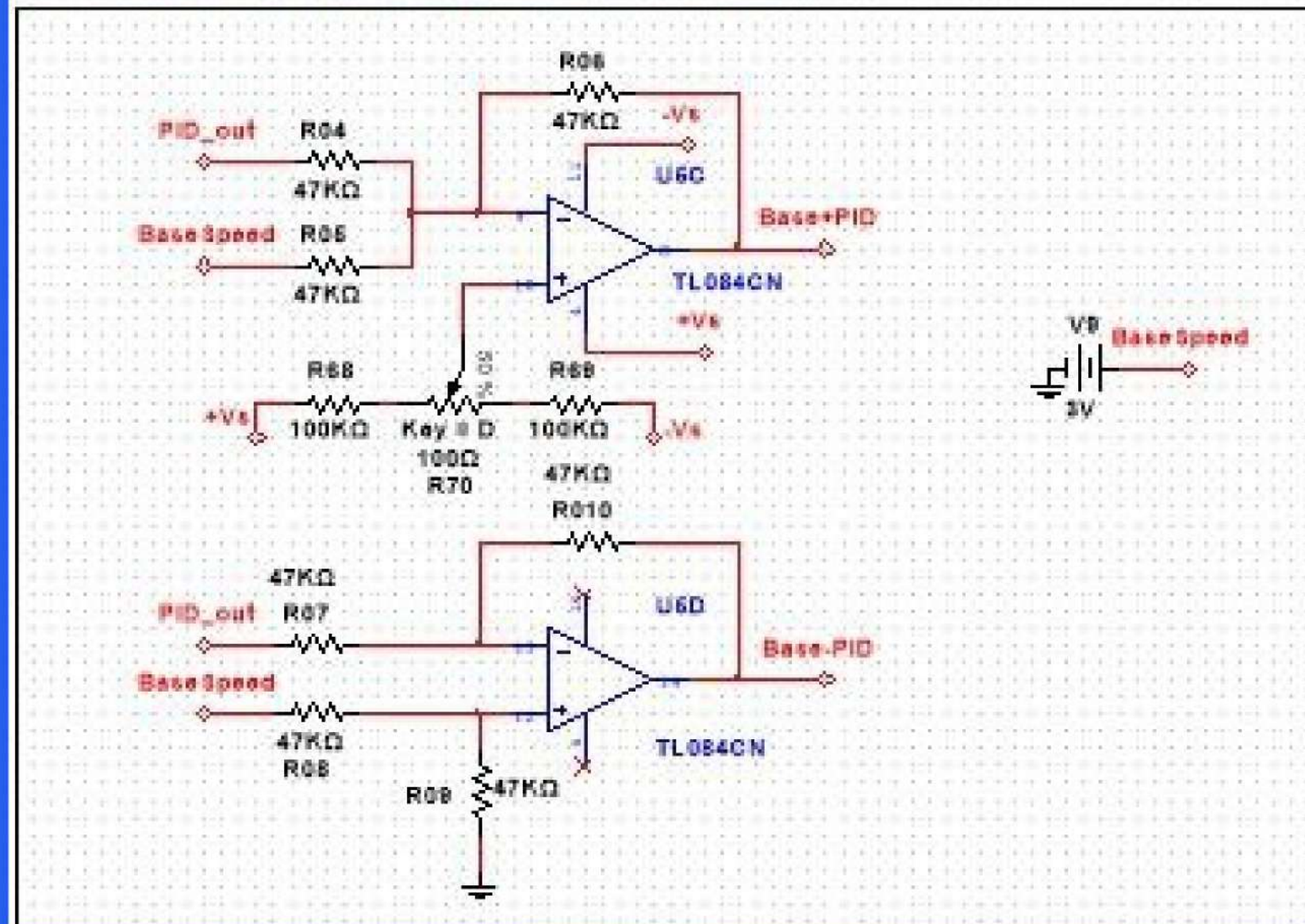


Control the error signal smoothly using feedback



CIRCUITS - Adder & Subtractor

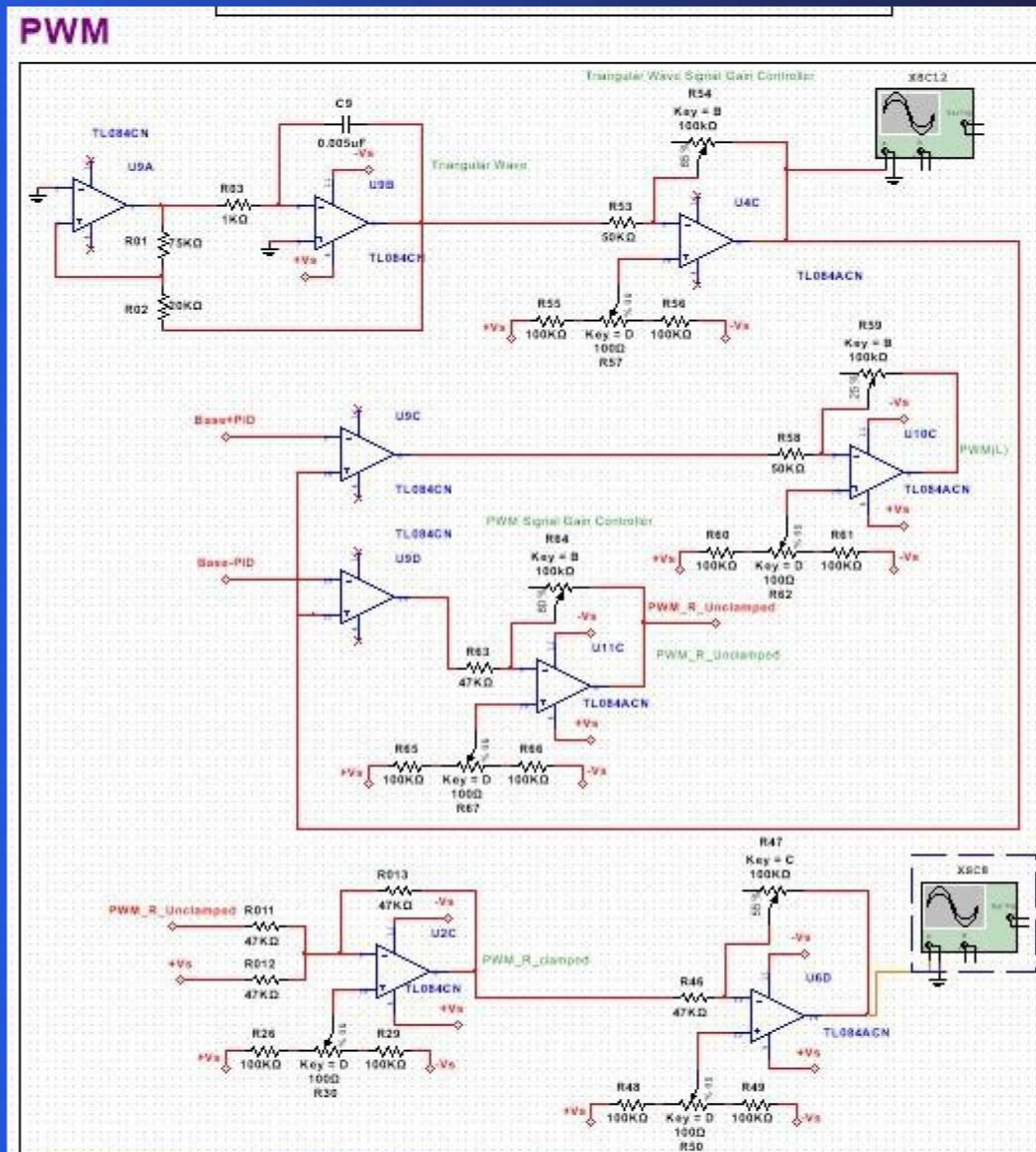
Adder and Subtractor



Generate two different comparator voltages for the two motors

motor 1 = base speed + PID output
motor 2 = base speed - PID output

CIRCUITS - PWM

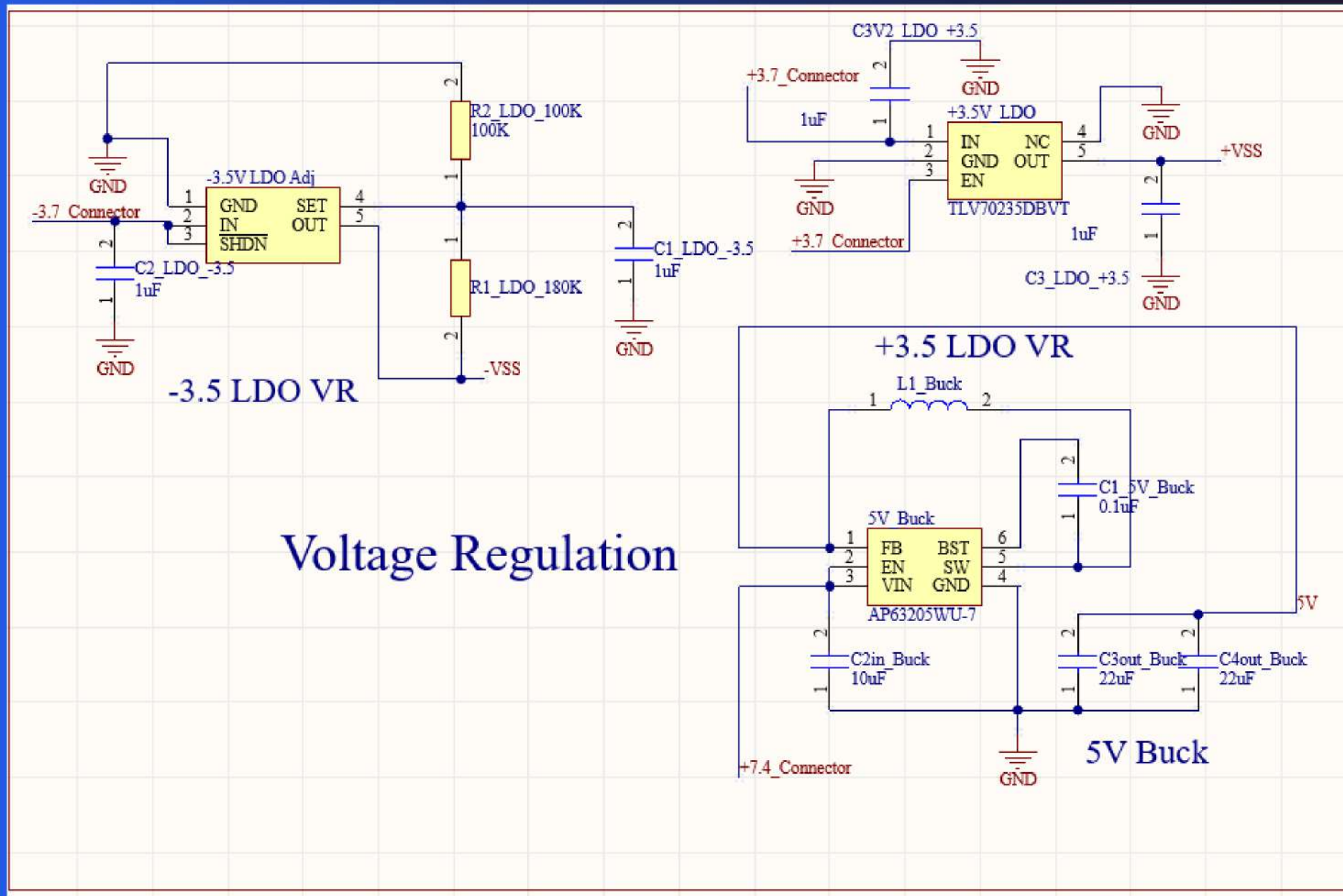


Generate two PWM signals with varying duty cycles according to PID output

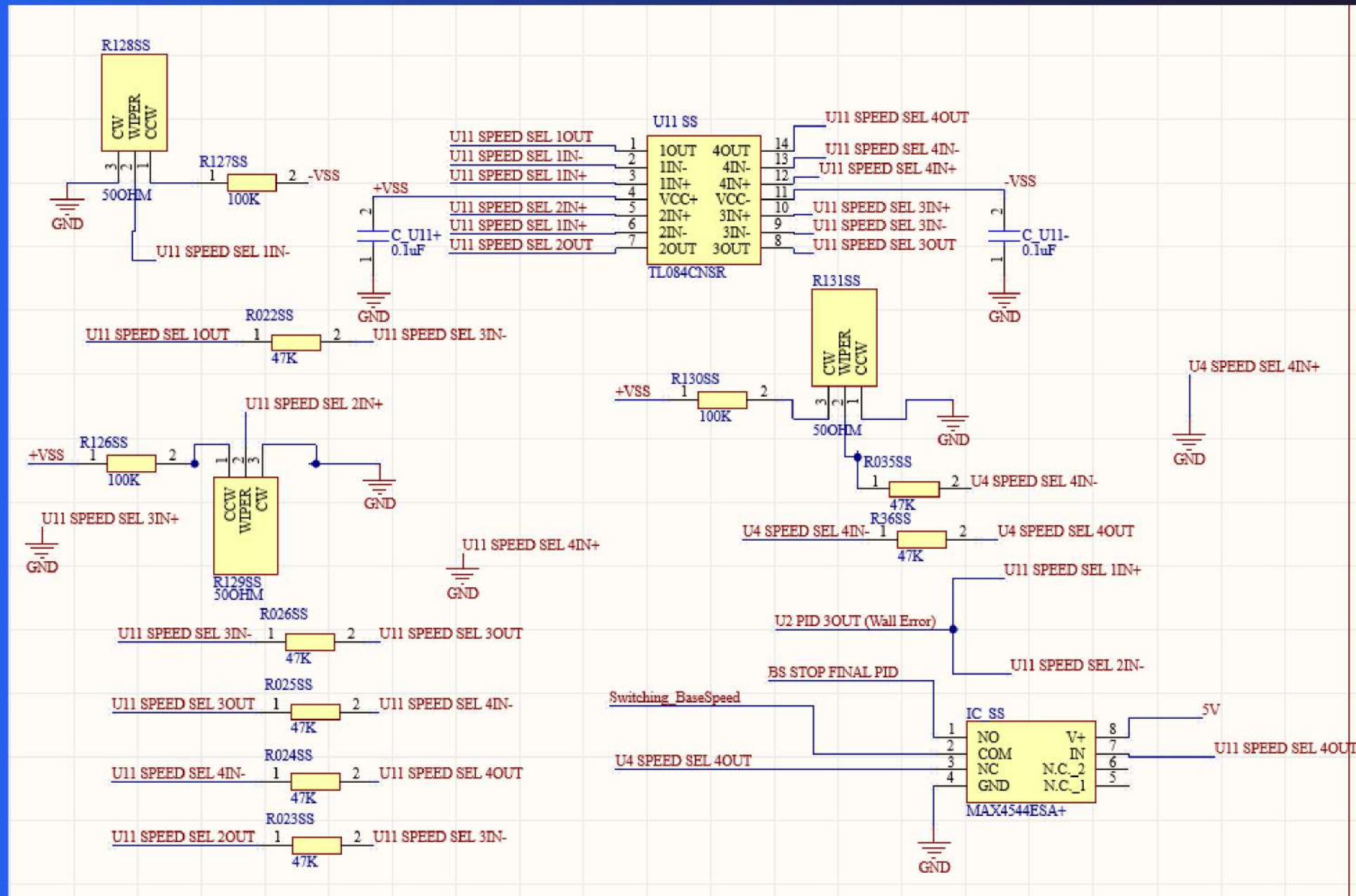
motor 1 duty cycle \propto base speed + PID output
motor 2 duty cycle \propto base speed - PID output

CIRCUITS - Voltage Regulator

To have 3.3V and 5V for the required parts accordingly

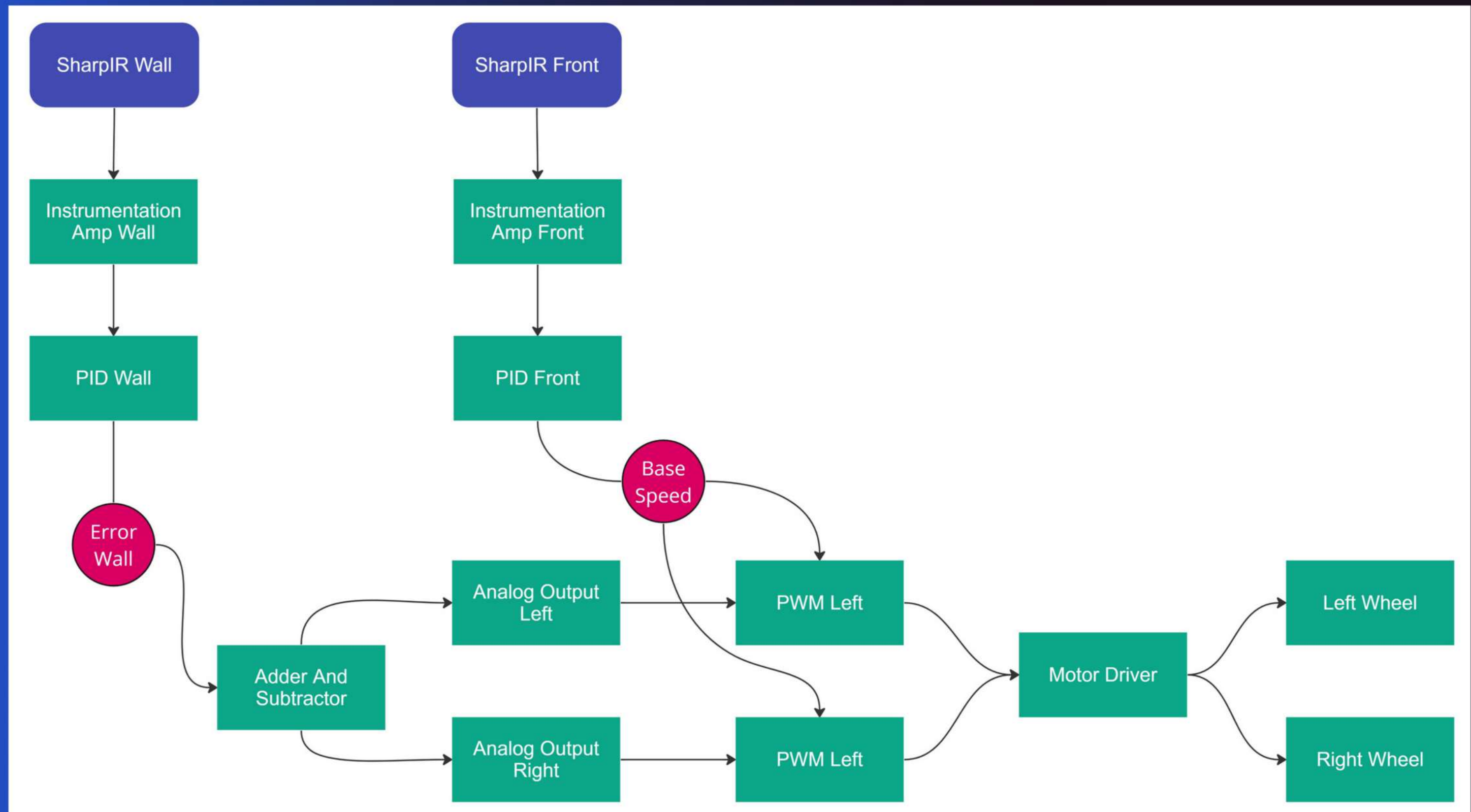


CIRCUITS - Speed Selector

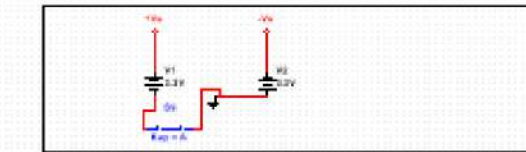


Manually Control the base speed.

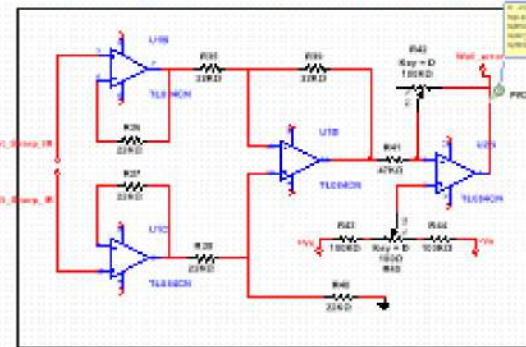
SYSTEM MODEL



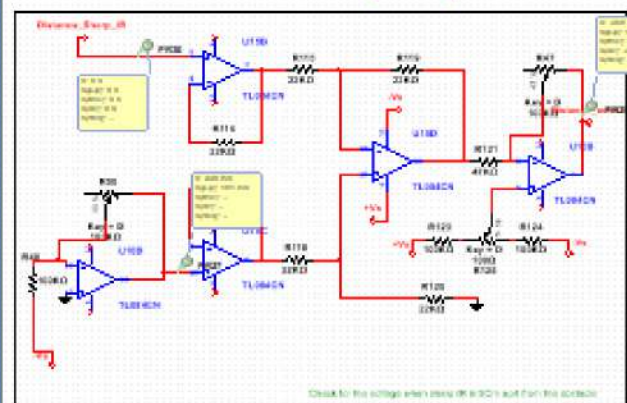
SCHEMATIC



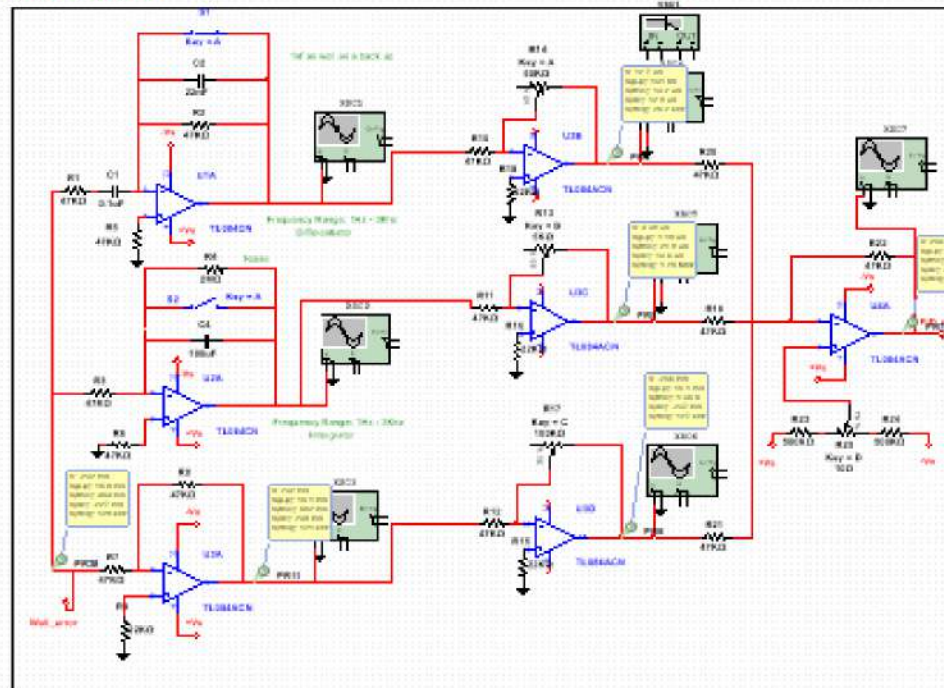
Instrumentation Amplifier (Wall Error)



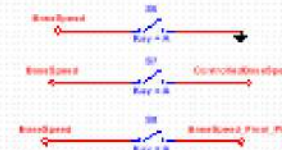
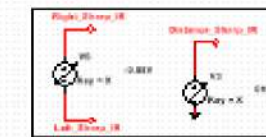
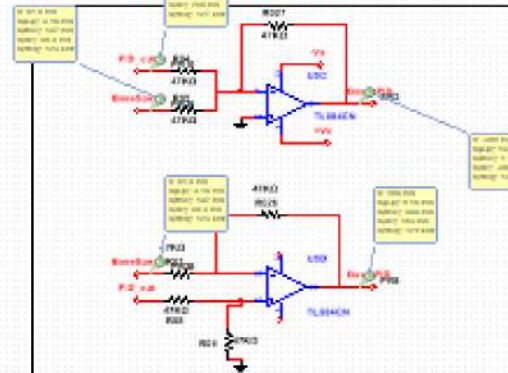
Instrumentation Amplifier (Distance Error)



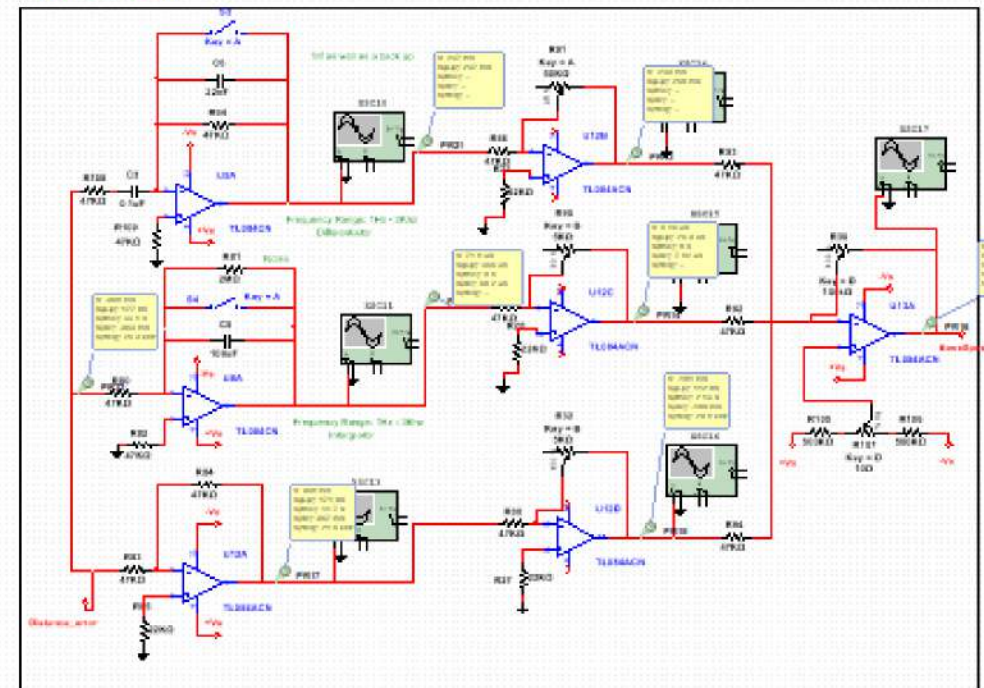
PID Circuit



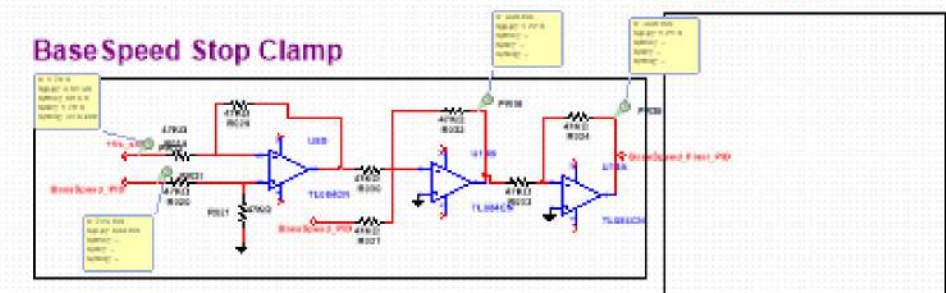
Adder and subtractor



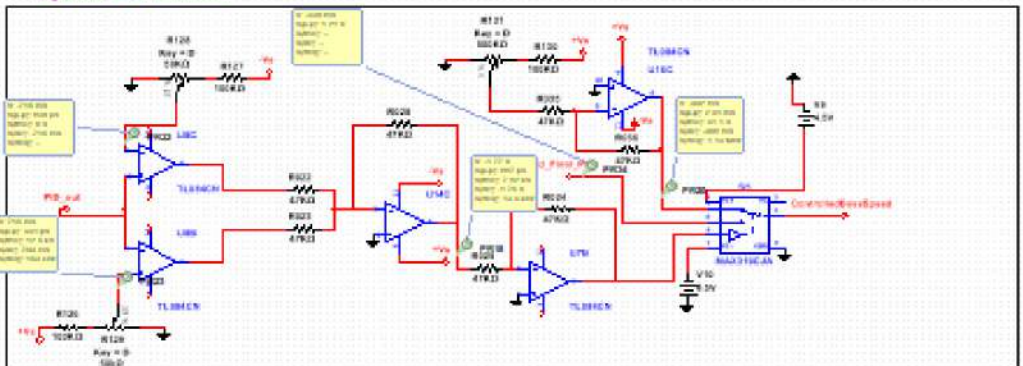
PID Circuit



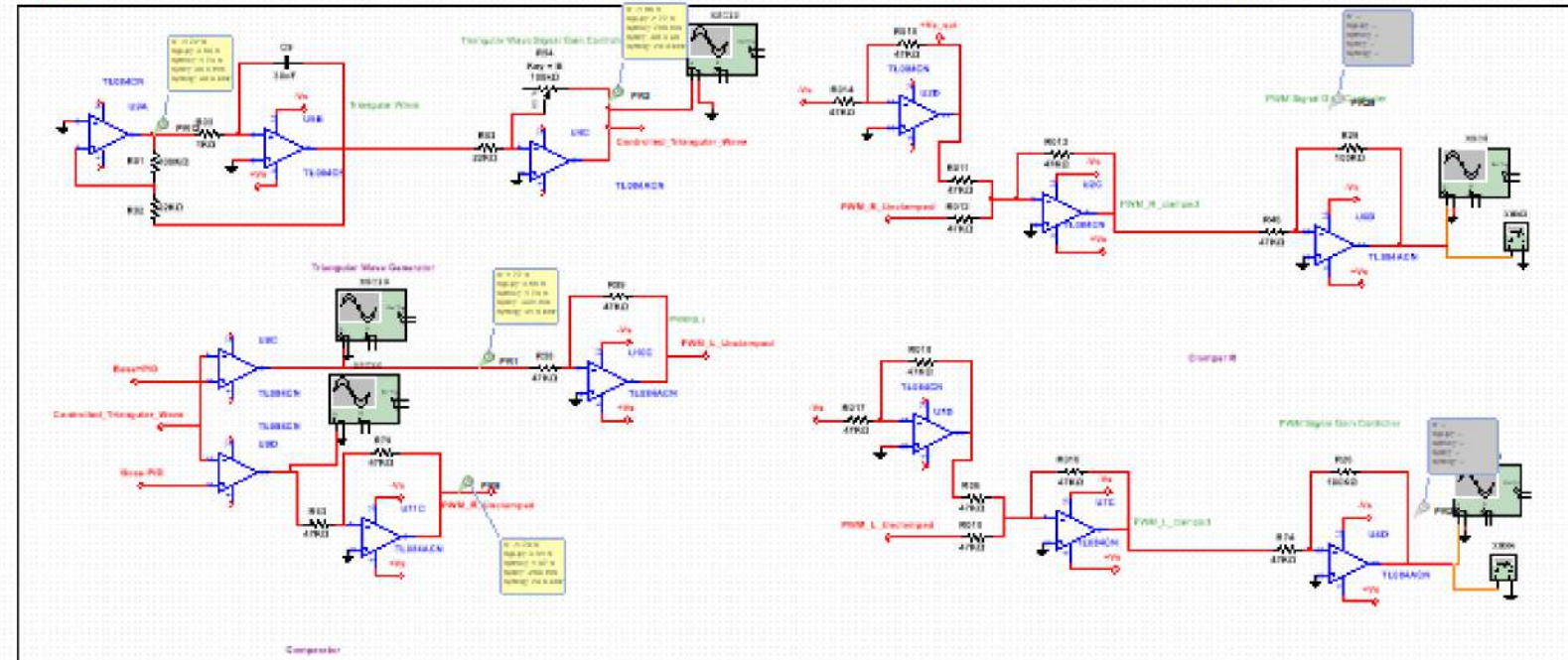
Motor Driver



Speed Selector

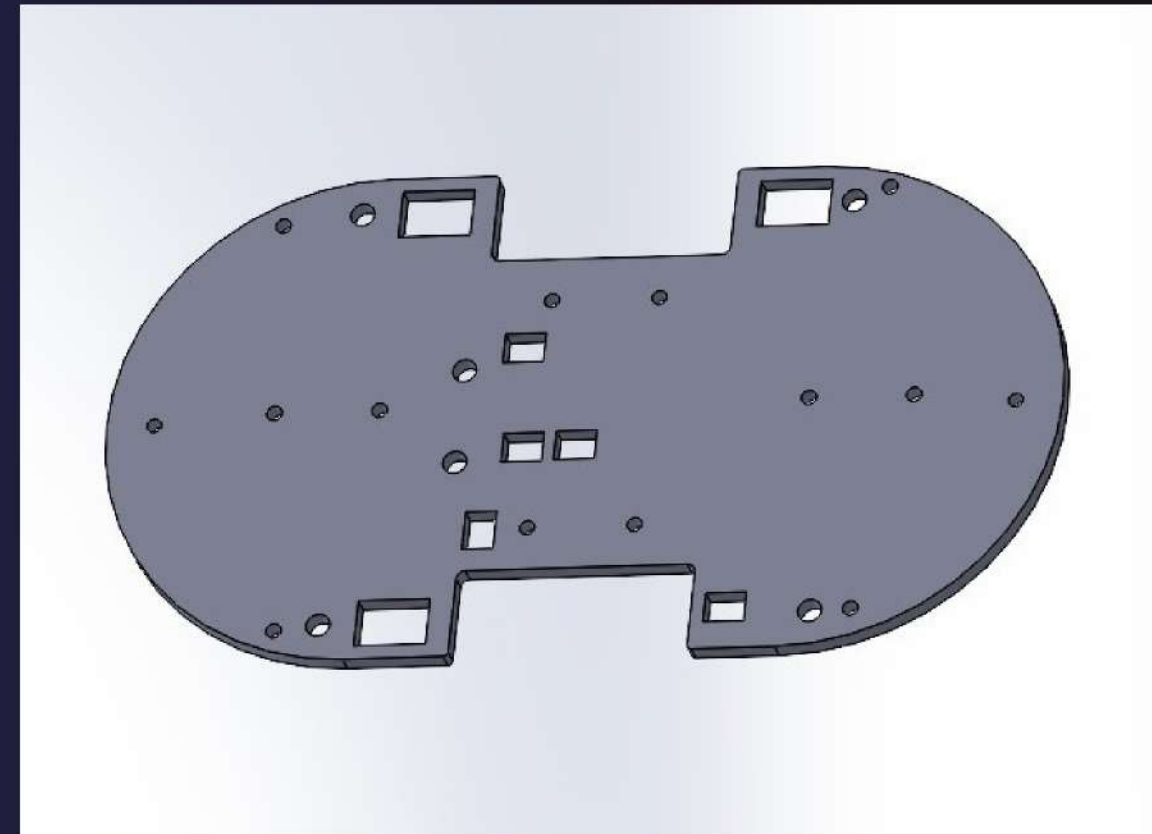
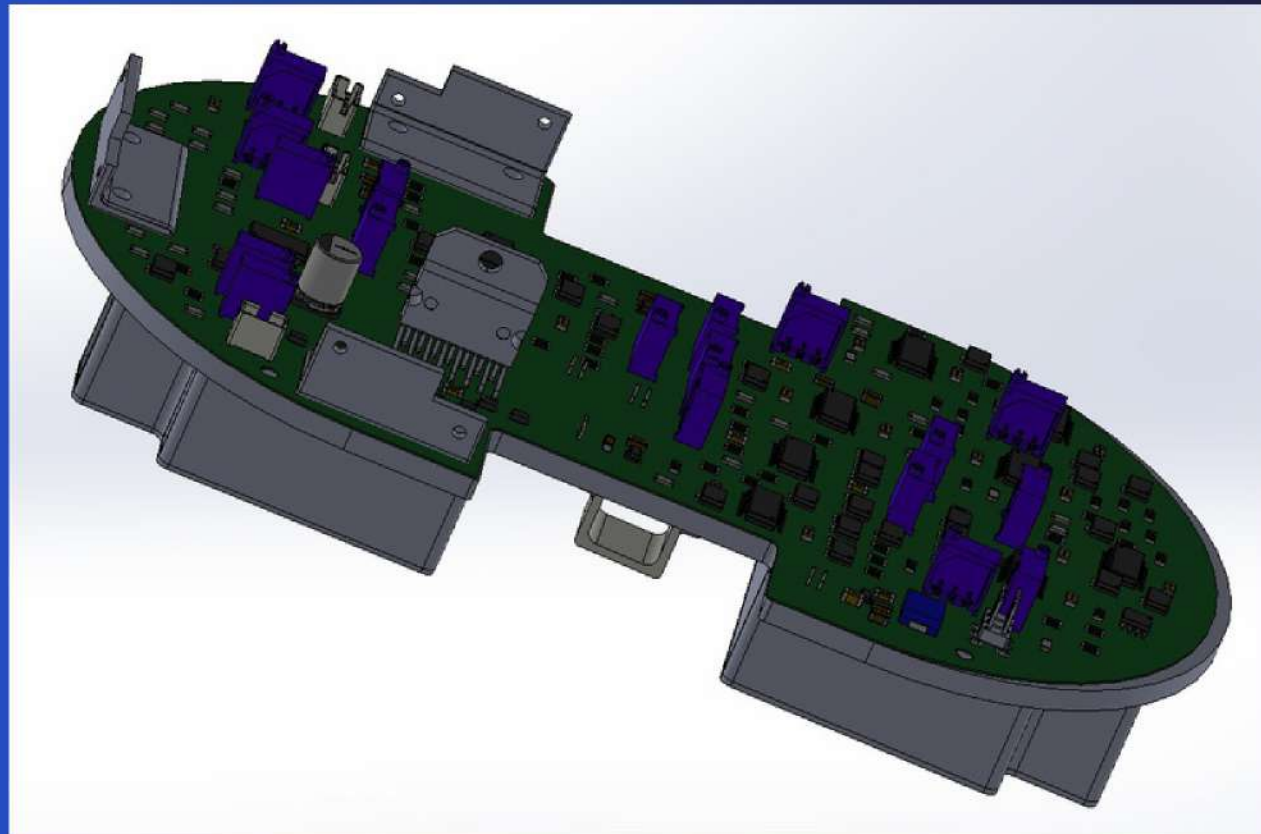
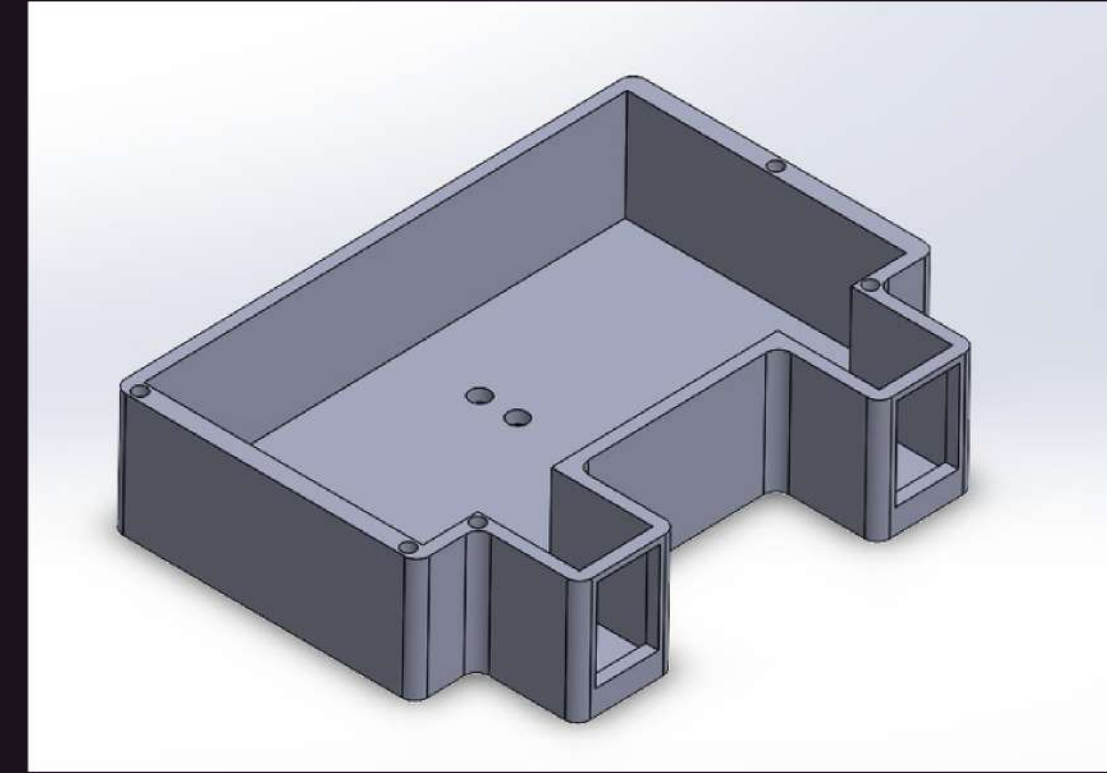
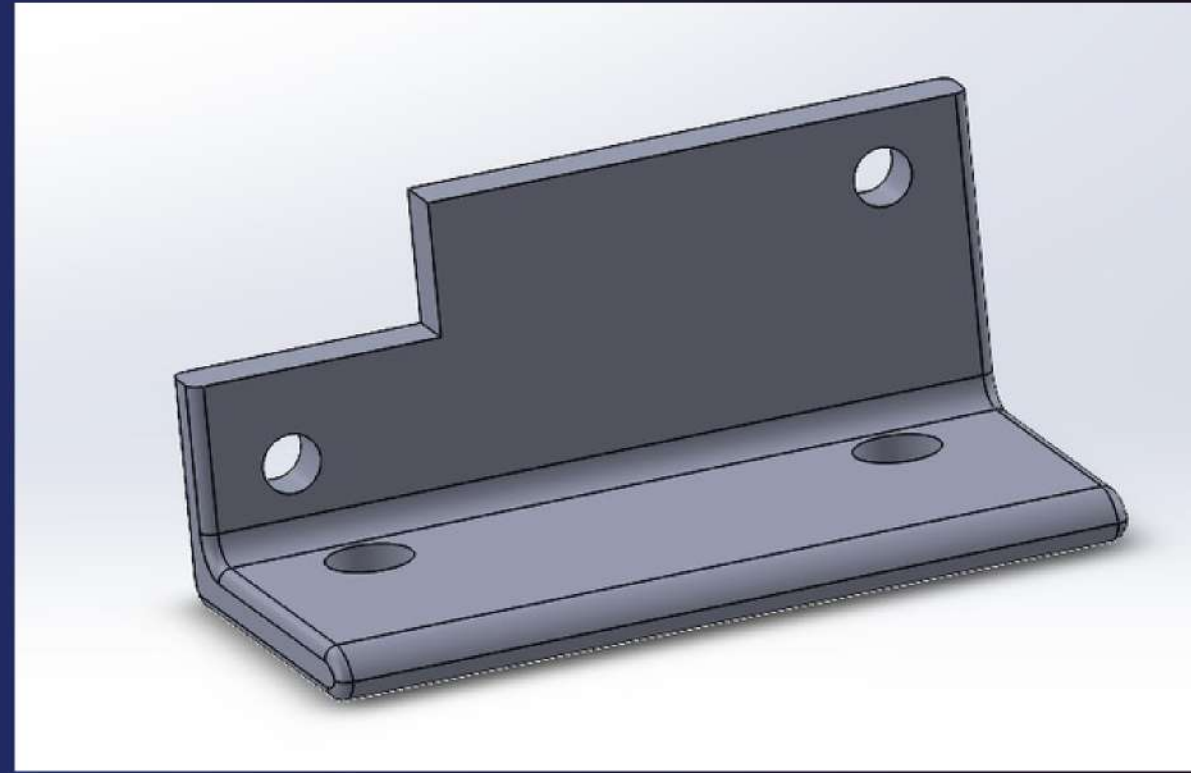
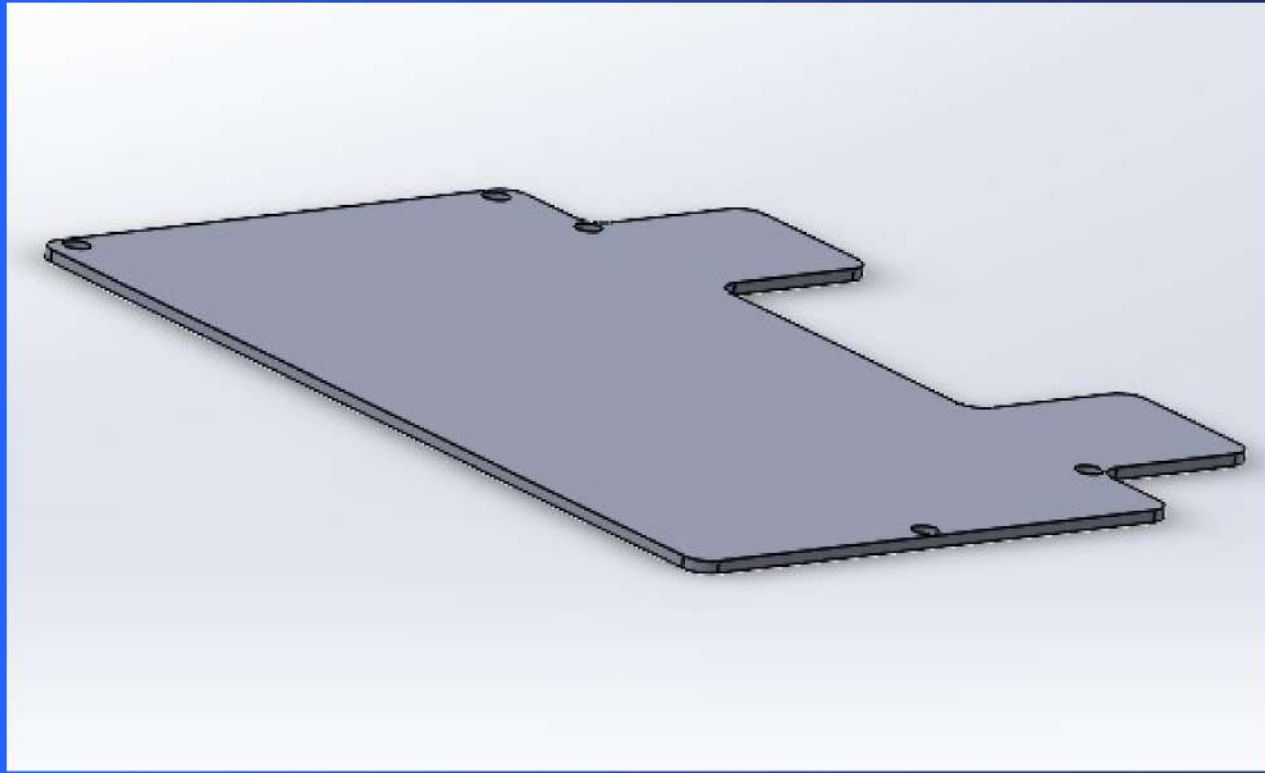


PWM



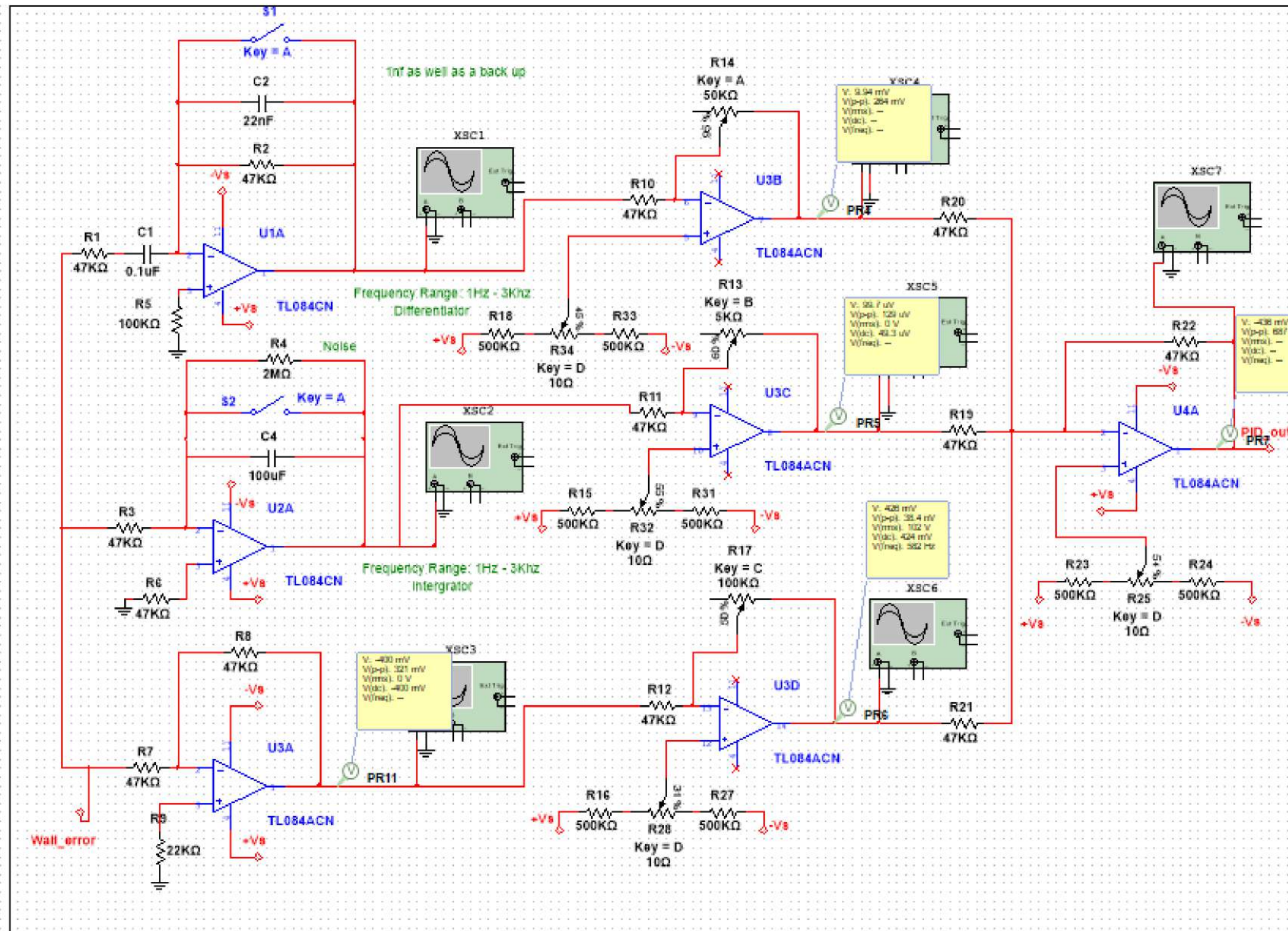
A detailed 3D perspective rendering of a custom printed circuit board (PCB) assembly. The PCB is green with intricate white and yellow circuit traces. Numerous components are mounted on the board, including several large blue electrolytic capacitors, various integrated circuits (chips) in black and white packages, and smaller surface-mount components. A prominent white component, possibly a connector or a specialized IC, is located in the center. The board has a complex, irregular shape with several mounting holes and a small blue component on the right edge. The overall presentation is a high-quality digital model of a physical electronic assembly.

ENCLOSURE DESIGN



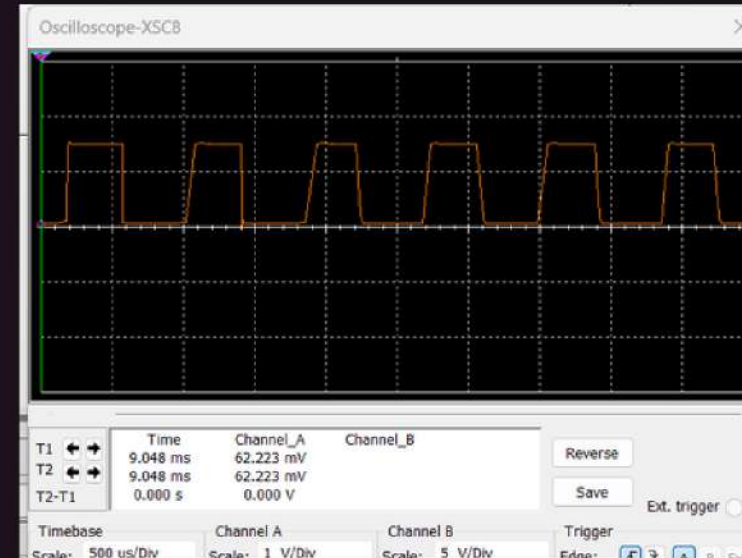
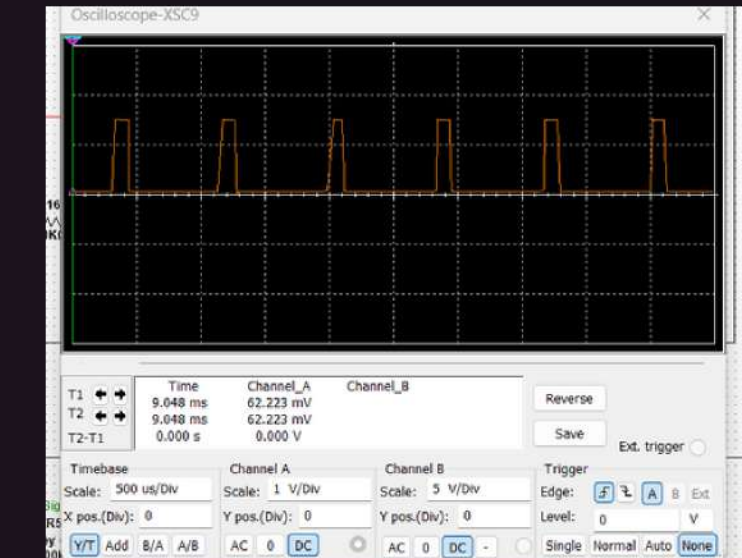
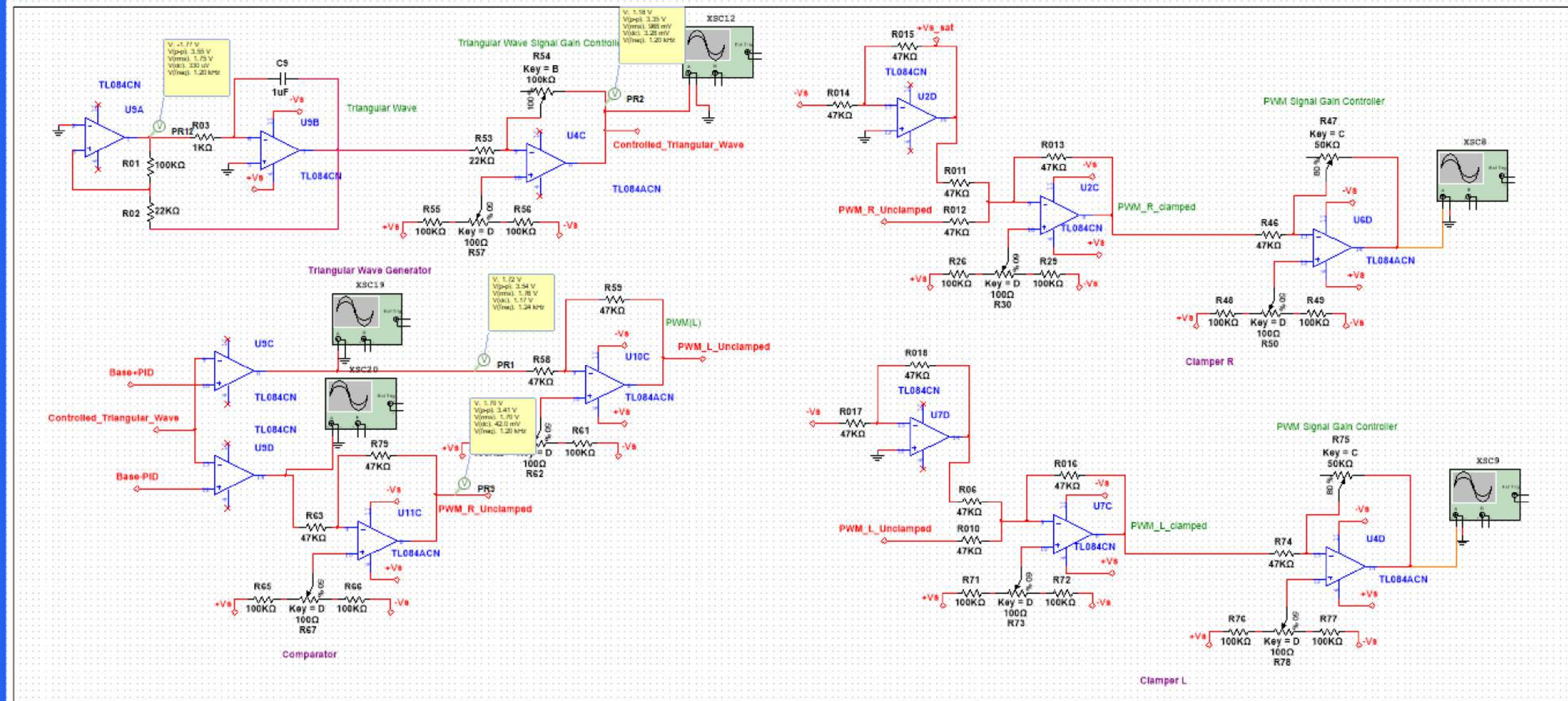
SIMULATION RESULTS - PID CIRCUIT

PID Circuit



SIMULATION RESULTS - PWM CIRCUIT

PWM



CONTRIBUTIONS



Sahan

**Enclosure
Designing**



Dinujaya

**PCB
Designing**



Ruchira

**Circuit
Designing**



Lasitha

**Soldering &
Testing**

THANK YOU