RaDAR

Automatic Solar Tracker

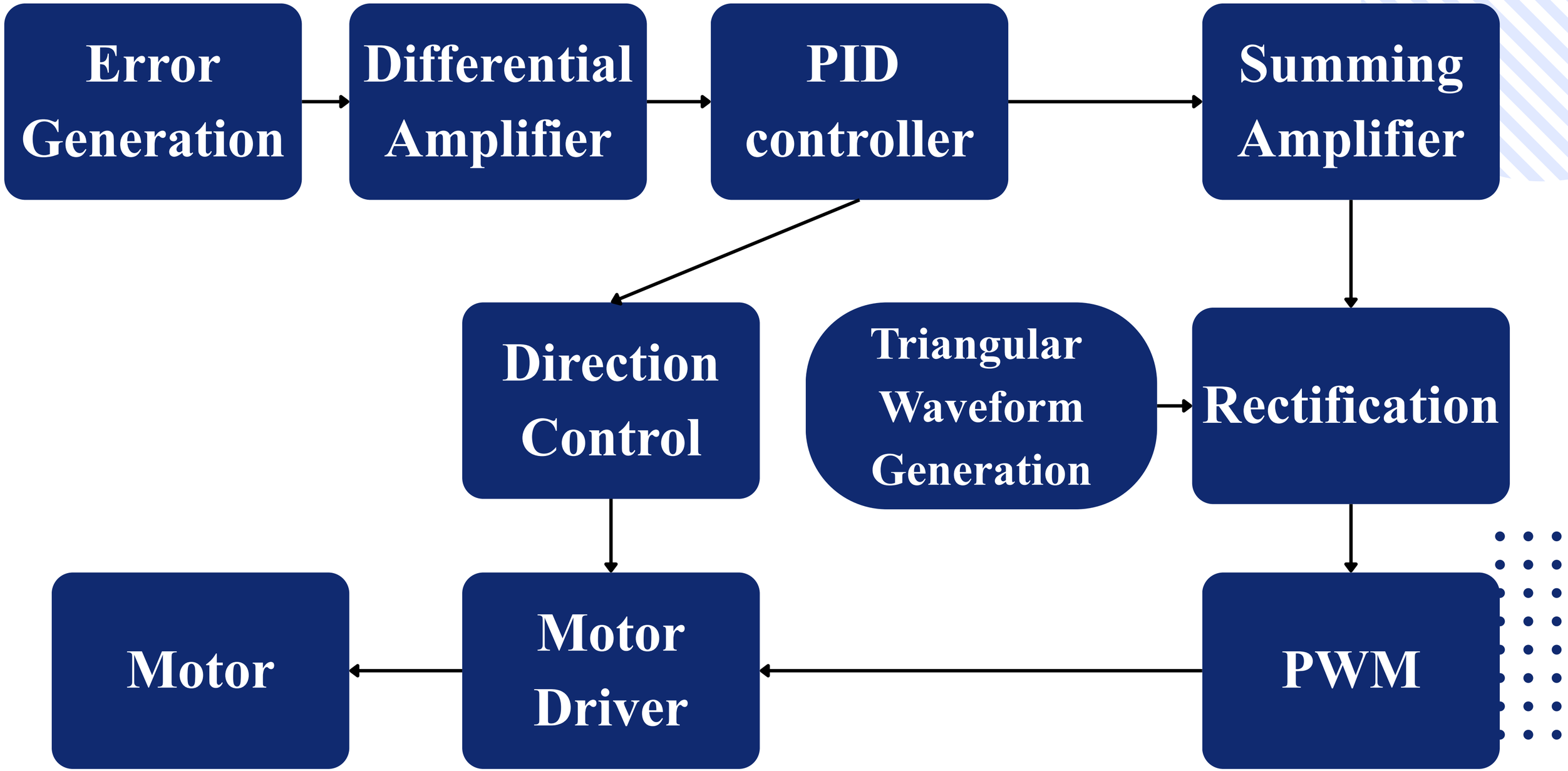
DE MEL D J 230121D
RAHMAN M F A 230507R
RAHUL B 230508V
RATHEESHAN A R 230539P

Introduction & Overview

Design an analog PID-controlled single-axis tracker that dynamically rotates a solar panel to maximize output by adjusting angle in response to sunlight intensity and incidence.

The analog PID solar tracker uses two LDRs to sense light intensity differences, generating an error signal that controls motor movement through proportional, integral, and derivative responses. Op-amp circuits produce a PWM signal by comparing a triangular wave and the PID signal to drive the motor via MOSFET and L298N, continuously aligning the solar panel for maximum efficiency.

Block Diagram



System Overview, specifications

- Sensors : 2 LDRs = To detect sunlight and generate error signals
- PID controller : To correct the error it adjusts the panels
  - P = Proportional
  - I = Integral
  - D = Differentive, are the components used for fine-tuning.
- Motor Driver : Receives the PWM signals by signals generated by error to adjust the panel angles

- Supply Voltage : +12V,-12V
- Motor Driver : L298N

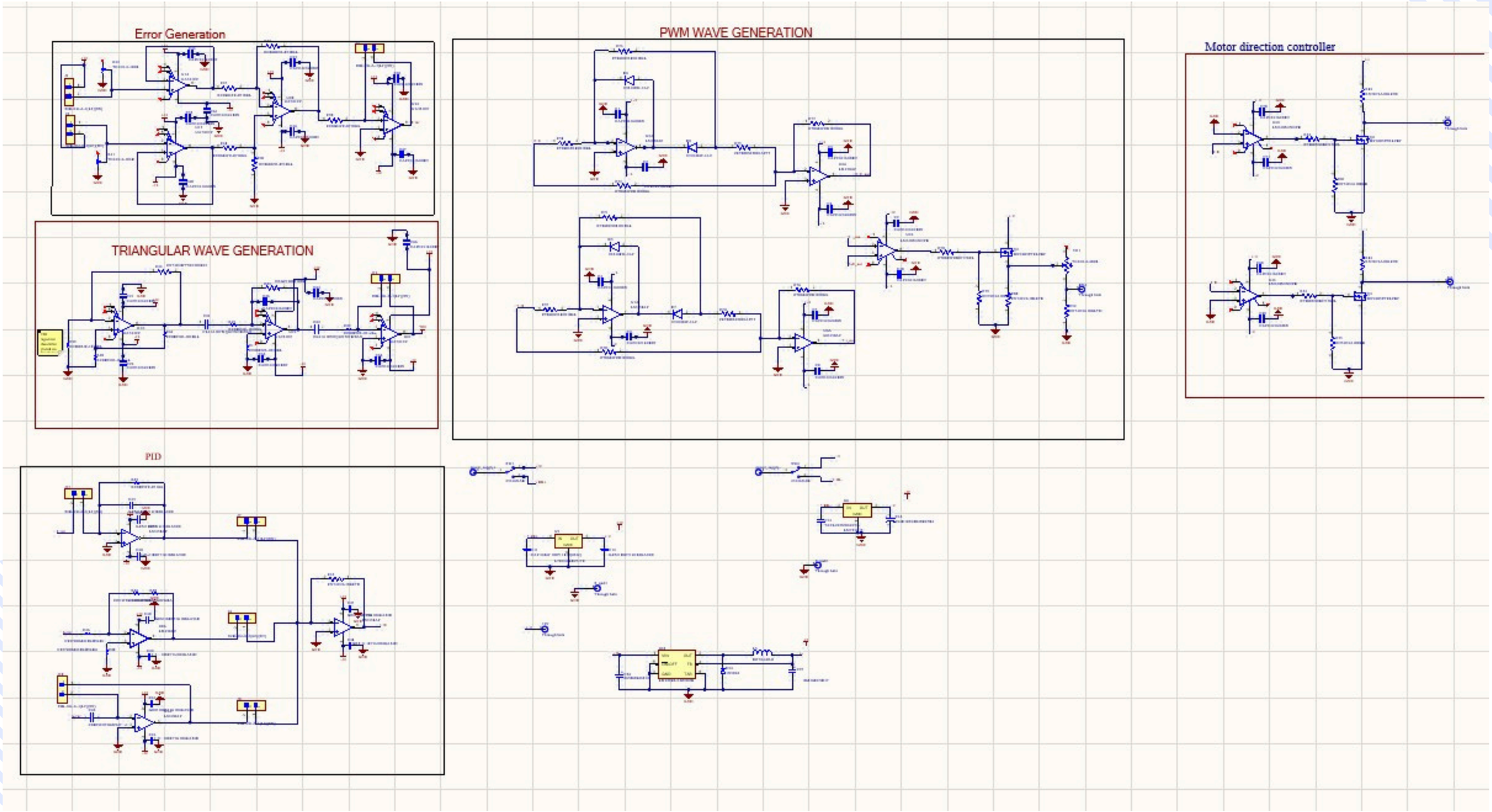
- LDR :
  - Dark = 1MΩ
  - Light = <5kΩ
- Diode : IN4007

System Overview, specifications

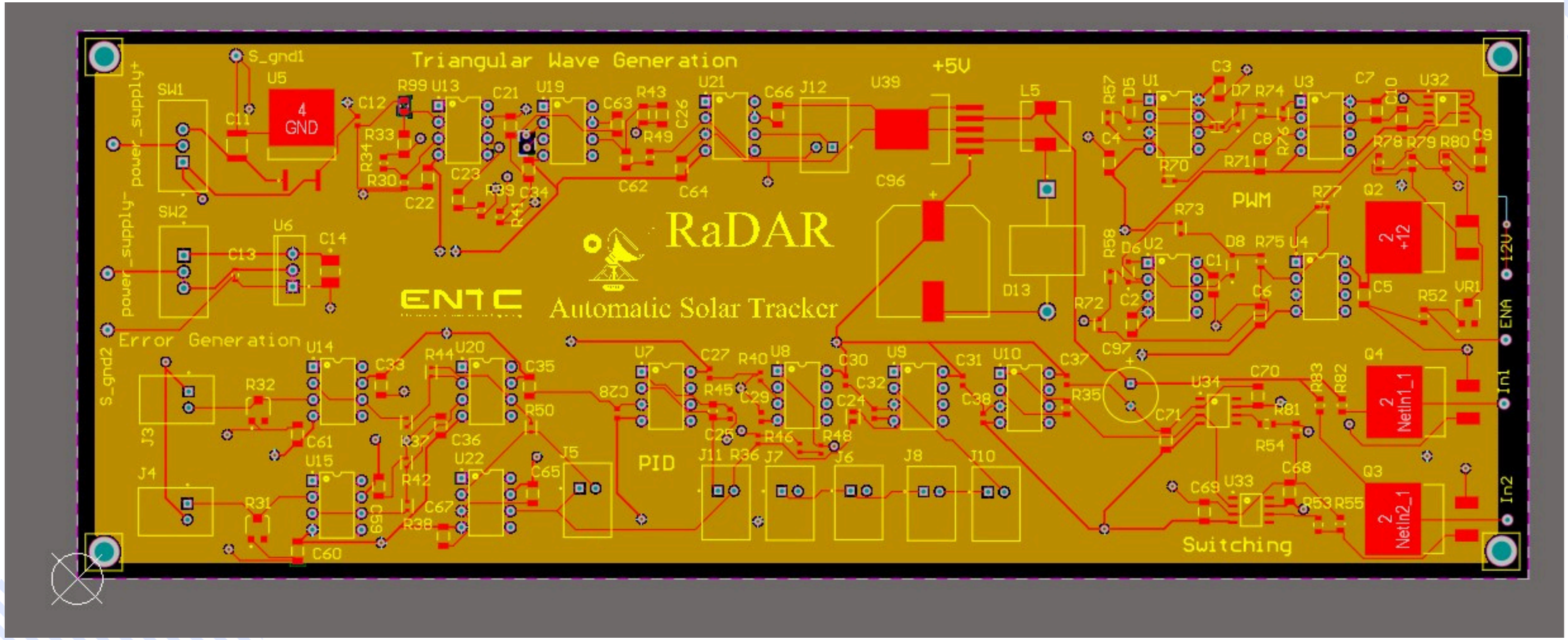
- Opamps:
  - **UA741** : High input impedance with strong CMRR (70dB - 90dB) for error sensing
  - **LM358AP** : Better input offset voltage, suitable slew rate to use in our control loop.
  - **LM318M** : Very high bandwidth, wide bandwidth used as a comparator
- **MOSFET** : IRF3205STRLPBF, n-channel used for fast switching

- **Power ICs** :
  - L7812ABD2T-TR - Used to reduce the high battery voltage to +12V
  - LM7912CT - Used to get the -12V for the OPAMPs
  - LM2596S-5.0/NOPB - Get stable +5V

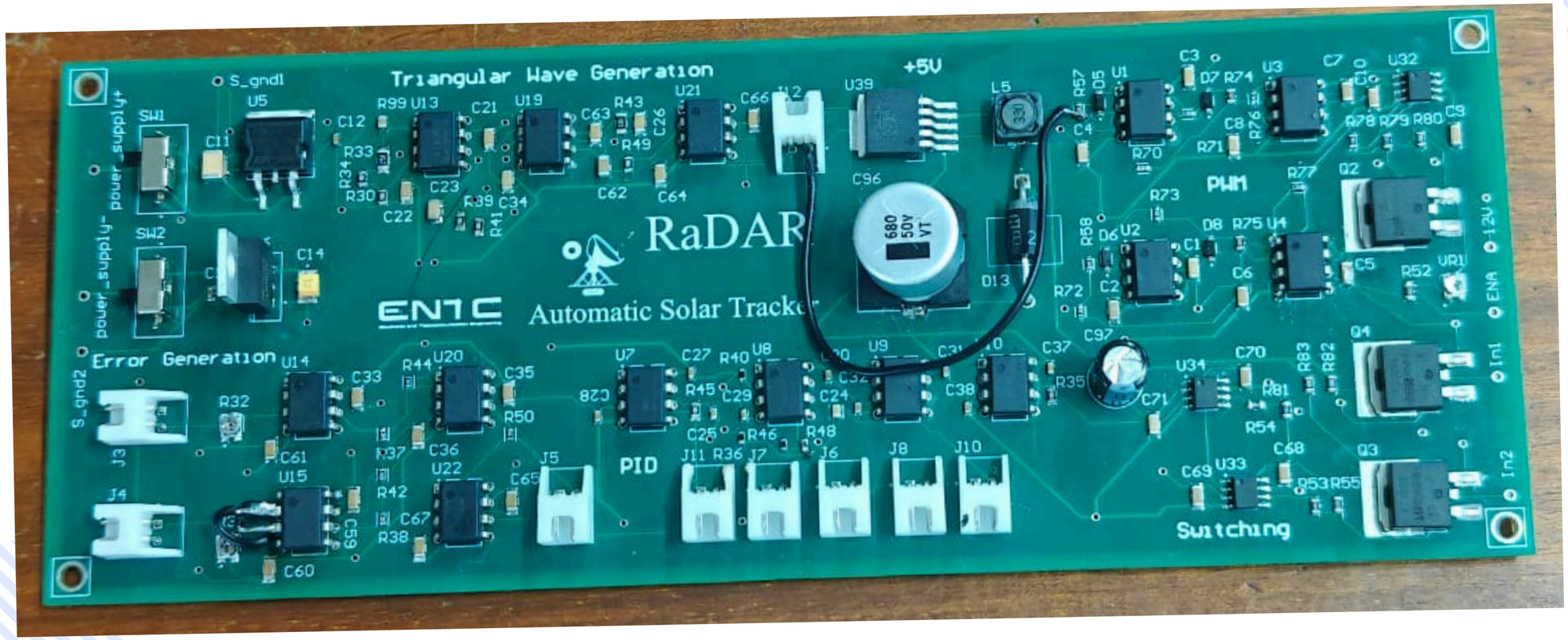
PCB SCHEMATIC



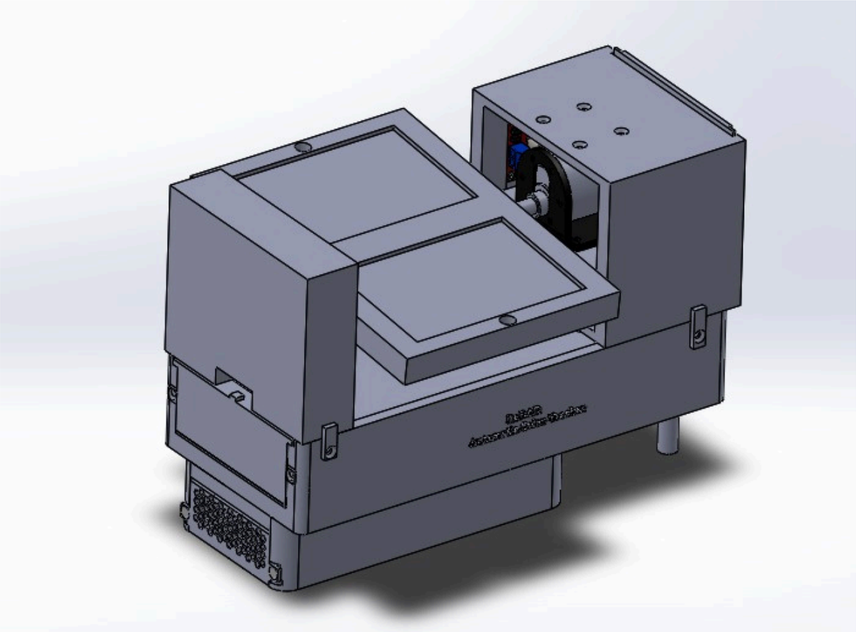
PCB 2D VIEW


Triangular Wave Generation
+5V
RaDAR
ENTC
Automatic Solar Tracker
PWM
Error Generation
PID
Switching
S_gnd1
power_supply+
power_supply-
S_gnd2
+12V
ENA
In1
In2
GND

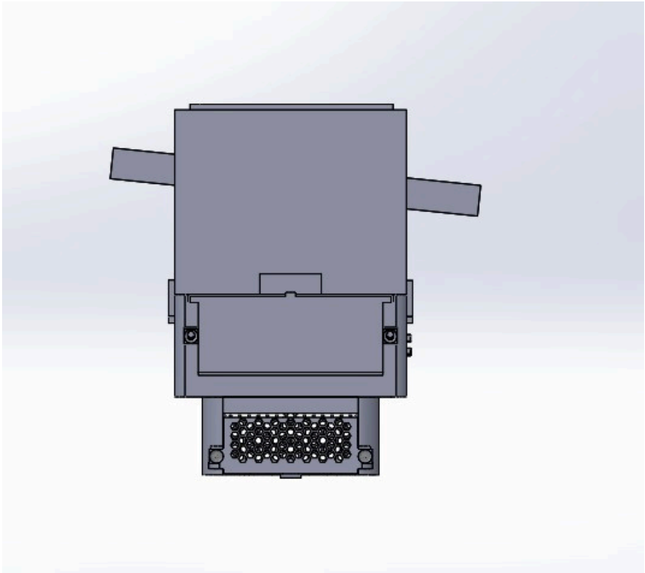
PCB

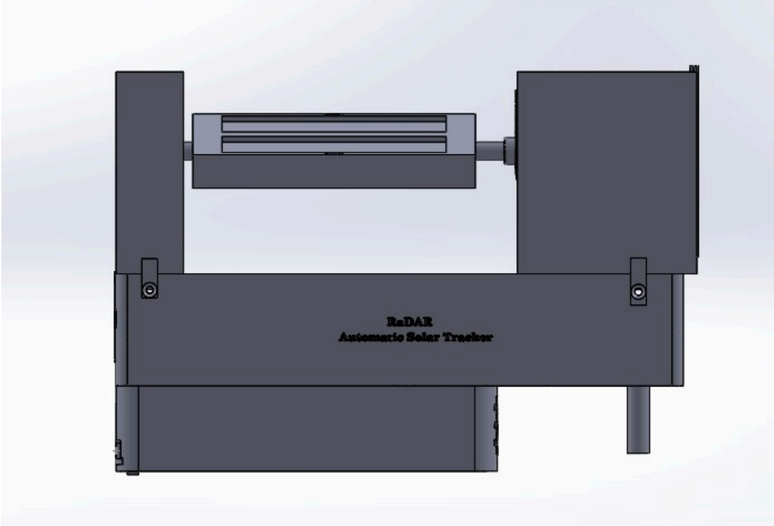

Triangular Wave Generation
+5V
S_gnd1
power_supply+
power_supply-
SW1
SW2
U5
RaDAR
ENTC
Automatic Solar Tracke
PWM
Error Generation
S_gnd2
PID
Switching
In1
In2
ENA
12V

Enclosure

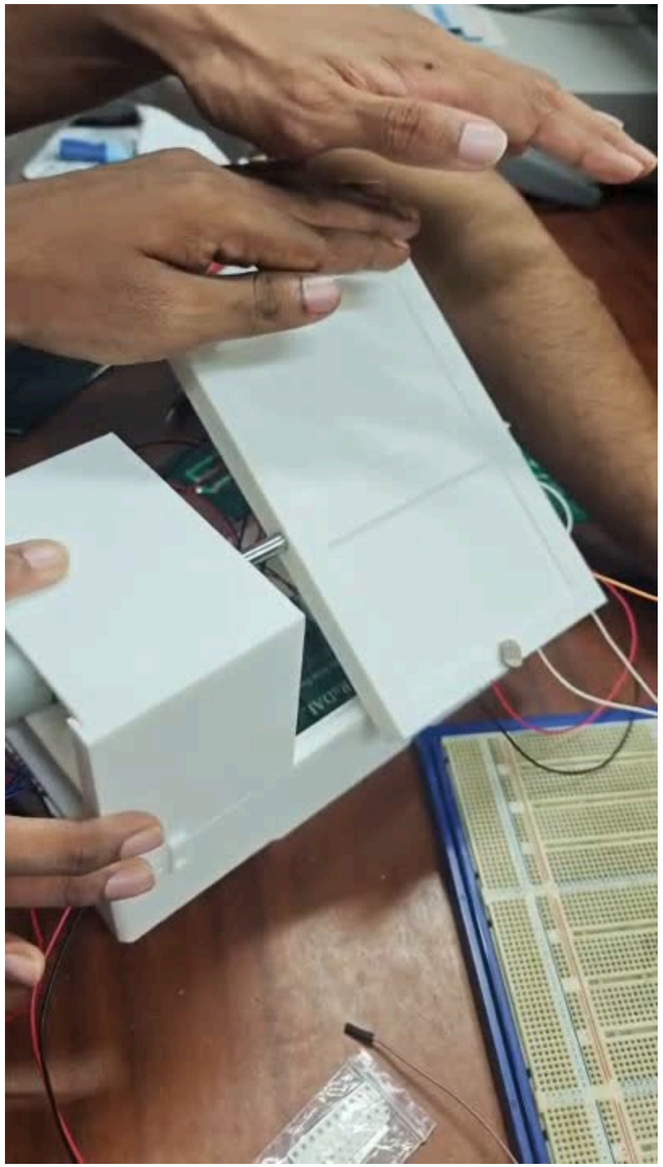



ANALOG
SOLAR
TRACKER
ReDAR
Automatic Solar Tracker
8-2




ReDAR
Automatic Solar Tracker

Initial Test



Final Testing

Future Improvements

Integrate a dual-axis tracking system to improve precision. Include real-time data logging of panel position, sunlight intensity, and power output. Add low-power standby mode and automatic night reset to reduce power consumption. Design a weather-proof enclosure for outdoor deployment and long-term stability.

Task Allocation

Name	Tasks
Deelaka	Circuit Design, Software simulation, Soldering
Abdul Rahman	Enclosure using SOLIDWORKS, Soldering
Rahul	Circuit Designing, Testing, Soldering
Rakesh	PCB Designing, Assembling, Soldering

Thank you