1. Introduction

The Analog Voltmeter Project combines traditional engineering with modern usability. Analog voltmeters, iconic instruments of electrical measurement, bridge the past and present. This project aims to revive and update these devices, blending classic charm with contemporary accuracy. By crafting smart circuitry and sleek design, we aim to preserve analog's essence while meeting today's precision needs. This introduction highlights our mission to merge tradition and innovation in voltage measurement.

2. Technical Specifications

1. **Measurement Range:** Design the voltmeter to accurately measure a voltage range of 100 mV – 10 V, by dividing this whole range into 2 or 3 sub-ranges and adjustable with selector switches.
2. **Accuracy:** Achieve a high level of accuracy, with a tolerance of ±1% or better, to ensure reliable voltage readings.
3. **Sensitivity:** Incorporate a sensitivity control mechanism to allow users to adjust the instrument's responsiveness to varying input voltages.
4. **Analog Display:** Implement a clear and easy-to-read analog display using a robust and calibrated analog needle or pointer.
5. **Input Impedance:** Maintain a high input impedance to prevent voltage drop when connected to circuits under test.
6. **Signal Conditioning**: Employ appropriate signal conditioning to reduce noise interference and enhance measurement accuracy.
7. **Overload Protection**: Integrate built-in protection to safeguard the voltmeter from potential damage due to excessive voltage inputs.
8. **Power Source**: Provide a reliable and stable power source, ensuring consistent and accurate meter operation.

9. **Calibration Mechanism**: Design a calibration mechanism or adjustment points to fine-tune the voltmeter's accuracy when needed.

3. Additional Notes

- All the circuits must be simulated using software (Ex- LT Spice, Multisim, PLECS etc.) before the implementation.
- All circuits should be tested on the breadboard and reviewed by the assigned supervisor before moving further.
- Circuits must be designed using professional EDA software (Altium Designer, OrCAD)
- Schematics should be verified and evaluated by the assigned supervisor.
- Design for manufacturability should be considered when designing the PCB Complete set of design and manufacturing documents Schematics, Layout, 3D file Gerber files, Assembly files BoM must be generated and properly documented.
- Students are encouraged to procure components from international component distributors (Mouser, DigiKey, Arrow Electronics, LCSC).
- Students are encouraged to get the PCBs manufactured from international PCB manufacturers (JLCPCB, PCBway).
- Main functionality of the project must be achieved with basic electronic components such as resistors, capacitors, inductors, diodes, transistors and other analog integrated circuits.
- Using any other pre-built programmable ICs are prohibited.
- Microcontrollers can be only used for user interface operation.
- Enclosure design must be done using a professional software (Solidworks).
- Enclosure and 3D model of the circuit must be assembled and inspected before manufacturing. 3D printing, Laser cutting, and Sheet metal bending can be used to manufacture the enclosure.
- Student are encouraged to consider the 3D model and PCB co-design (design in parallel by taking their integration into consideration) when designing.
- Final implementation of the project needs to done in a PCB.
- Follow provided “General guidelines”.