ECE 412 - 1 Minute TED Talk #2

TEAM-03 - COATL-AIRCRAFT

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Remind Us What Your Capstone is

Particles in the atmosphere, such as volcanic ash, mineral dust, and wildfire smoke, pose risks to aviation by damaging engines, eroding components, and potentially causing engine failure. A good example of this is seen in the 1982 Jakarta incident, where British Airways flight 009 flew through volcanic ash from Mount Galunggung (in Indonesia), causing all four engines to fail. Additionally, aircraft in dusty environments, like the Middle East, experience accelerated wear and tear compared to those in cleaner air.

This capstone project aims to construct an electrostatic dust analyzer (EDA) to detect particle clouds and volcanic ash during flight by measuring currents induced by electrostatically charged particles. The EDA will provide real-time particle data, aiding pilots in identifying hazards like volcanic ash and wildfire smoke. Beyond emergencies, widespread deployment of EDAs could offer helpful information about atmospheric dust trends.

Update Us on What Changed About Your Capstone

Our faculty advisor/sponsor Josh Mendez has been very straightforward with their requirements for the project. All of our “Must” requirements of the device being able to detect particles and being sensitive to electrostatic charge, as well as the “Shoulds” of having low power consumption, being small in size, and being able to determine the size of particles remain the same. The only suggested change that he would like to see would be the addition of multiple channels and electrode meshes for more data acquisition.

Meaningful Technical Progress

So far, our team has created the circuit schematic for our product’s prototype in LTSpice. We have also submitted a buy order for the parts we plan to use, since our schematic was confirmed by Josh. This schematic is soon to be created using a breadboard and the ordered components. Additionally, we are beginning to look into the physical design, specifically around 3D printing for prototyping. Machining work will begin once the circuit is working properly and the external design is confirmed.

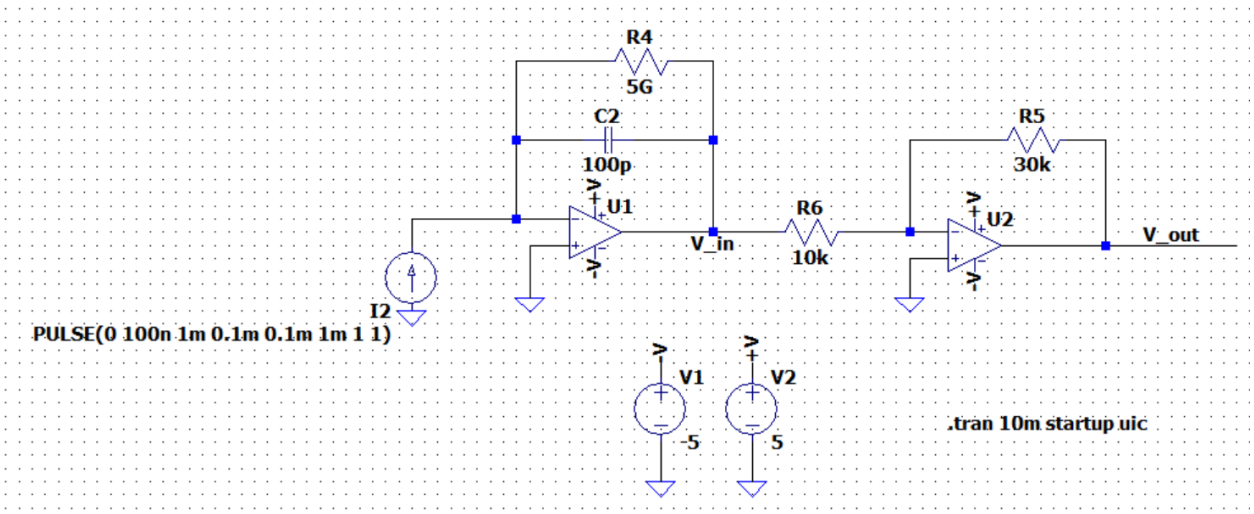

Figure 1: Circuit Schematic of the Coulombmeter (1st Stage) and Amplifier (2nd Stage) with a Negative Rail, not a Virtual Ground.

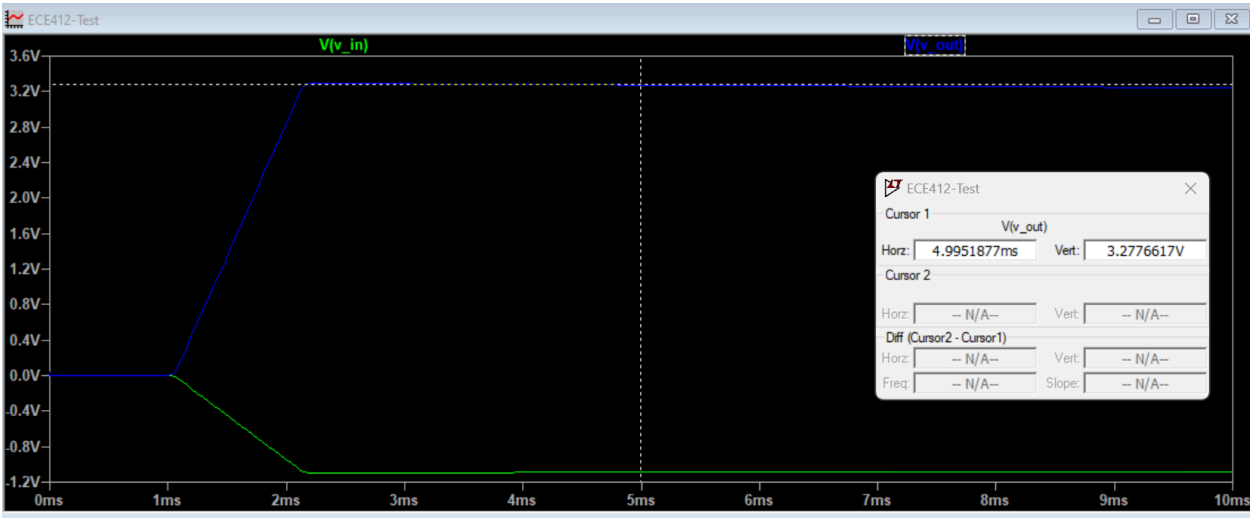

Figure 2: Circuit Simulation

	Item Description	Catalog #	Unit (example: case,	Quantity	Amount per Unit	Item Total
1	Operational Amplifiers - Op Amps Dual 15.5-V 100-kH z operational am	926-LMC6042IMX/NOPB	Cut Tape	3	$ 2.75	$ 8.25
2	Precision Amplifiers Prec CMOS Sgl Op Amp A 926-	926-LMC6081IN/NOPB	Through Hole	3	$ 3.07	$ 9.21
3	Thick Film Resistors - Through Hole 5000M ohms 1%	588-SM102035007FE	Through Hole	2	$ 5.58	$ 11.16
4						$ -
5						$ -
6						$ -
7						$ -
8						$ -
9						$ -
10						$ -
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17						$ -
18						$ -
19						$ -
20						$ -
21						$ -
22						$ -
23	**Estimated Total**					**$ 28.62**
24						

Figure 3: Official Parts Order