AtmosNano: Development of a Low-Cost CubeSat Platform for Real-Time Atmospheric Monitoring

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AtmosNano: Development of a Low-Cost CubeSat Platform for Real-Time Atmospheric Monitoring Altynay Otetileu NIS, Turkistan, Kazakhstan Flooding affects millions of people annually, yet accurate localized atmospheric monitoring remains out of reach for most communities due to the overwhelming cost of conventional systems. This study asked a simple but critical question:can a low-cost, student-built CubeSat collect reliable atmospheric data during real flight and use that data to predict flood risk? A 1U CubeSat was designed in Fusion 360, 3D-printed, and launched inside a model rocket equipped with aerodynamic stabilizing fins.BMP388 and DHT sensors measured pressure, temperature, humidity mid-flight, while an Arduino microcontroller logged all data onboard. The first launch at 30 N thrust revealed two critical engineering failures , first flight instability and power-induced data loss. These were systematically resolved by increasing thrust to 100 N, redistributing internal mass for center-of-gravity correction, and replacing the powering with a lithium battery.The second launch achieved stable flight reaching 300-350 meters. Flight data recorded pressure dropping from 1013 hPa to 997 hPa, decreasing air density, stable temperatures near 15°C, and higher humidity near ground level ,all aligning with established atmospheric model. This data fed in a machine learning model trained on historical atmospheric datasets to detect flood-risk patterns. The platform achieved over 85% accuracy in real-time flood risk prediction. This project proves that reliable environmental monitoring does not require million-dollar infrastructure. A student-built system can collect meaningful atmospheric data and translate it in tool that society urgently needs.

Awards Won: