Challenge – track 2, satellite image training

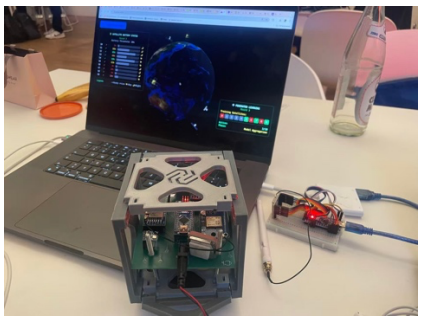
The original implementation uses the EuroSat data for training and evaluating. The dataset is split into 80% training data and 20% testing data. It mocks 10 clients/satellites, each trains the model locally and transmits only lightweight model updates. On the ground, the model weights are aggregated and the performance is tested on the test set. The baseline accuracy is between 65%-70%.

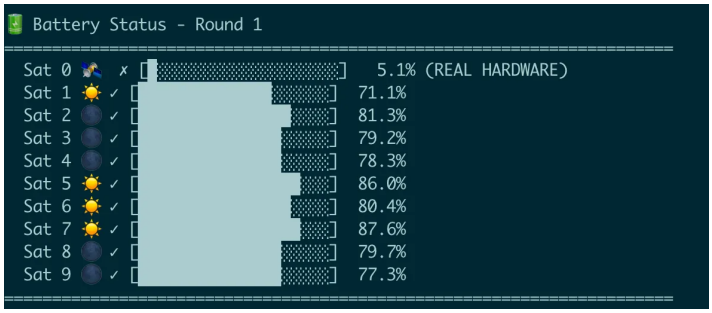
Problems we want to solve:

1. **Resource Constraints** Satellites have limited resources, such as battery, compute, temperature etc. In this demo, we focus on battery constraint and only select the satellites that have enough battery for training.

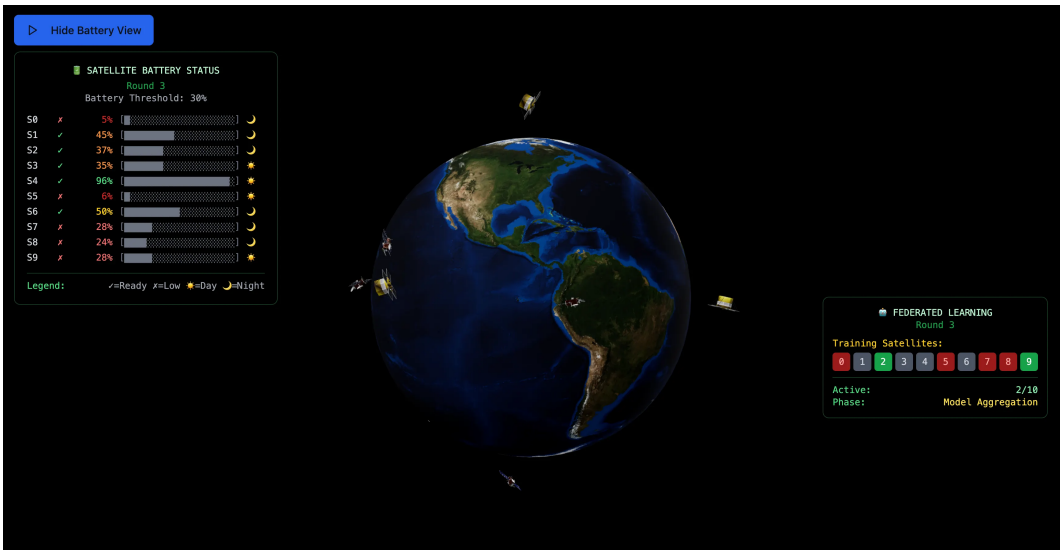
We mock the battery for each client in the following way: We set an initial battery of 80% for each satellite. Running a local epoch consumes 15% battery, so training is expensive. When a satellite is in sunlight it recovers 3 % battery per simulation tick. Clients below 30 % are automatically skipped to preserve lifetime.

To make the demo realistic, in addition to the simulated fleet, we added a real CubeSat as one of the client. The `cubesat-enabled` flag can ingest battery telemetry from a real CubeSat so it can demo how live hardware fits into the same selection logic.





We also made an interactive UI to demonstrate the battery status of each satellite and how they were selected.



1. **Communication/Bandwidth Constraints**

Satellites have limited bandwidth and we want to save cost while retaining the accuracy. Here, we compressed the model size drastically while still retain similar accuracy.

We tried other models like ResNet, which improves the accuracy from ~70% to ~90%. Statistics are shown below:

model_metrics

timestamp	run_dir	model_variant	total_params	payload_kb	final_accuracy
2025-11-15T14:48:24.091457	2025-11-15/14-47-34	baseline	434602	1707.02	0.7189
2025-11-15T14:51:10.378890	2025-11-15/14-50-24	basemodel-compressed	16506	76.24	0.6789
2025-11-15T14:56:13.356490	2025-11-15/14-52-43	resnet	11181642	43754.76	0.9044
2025-11-15T15:14:34.324070	2025-11-15/15-13-33	basemodel-battery-control	434602	1707.02	0.6741