Speech Recognition in Embedded System as a Smart-Home Device

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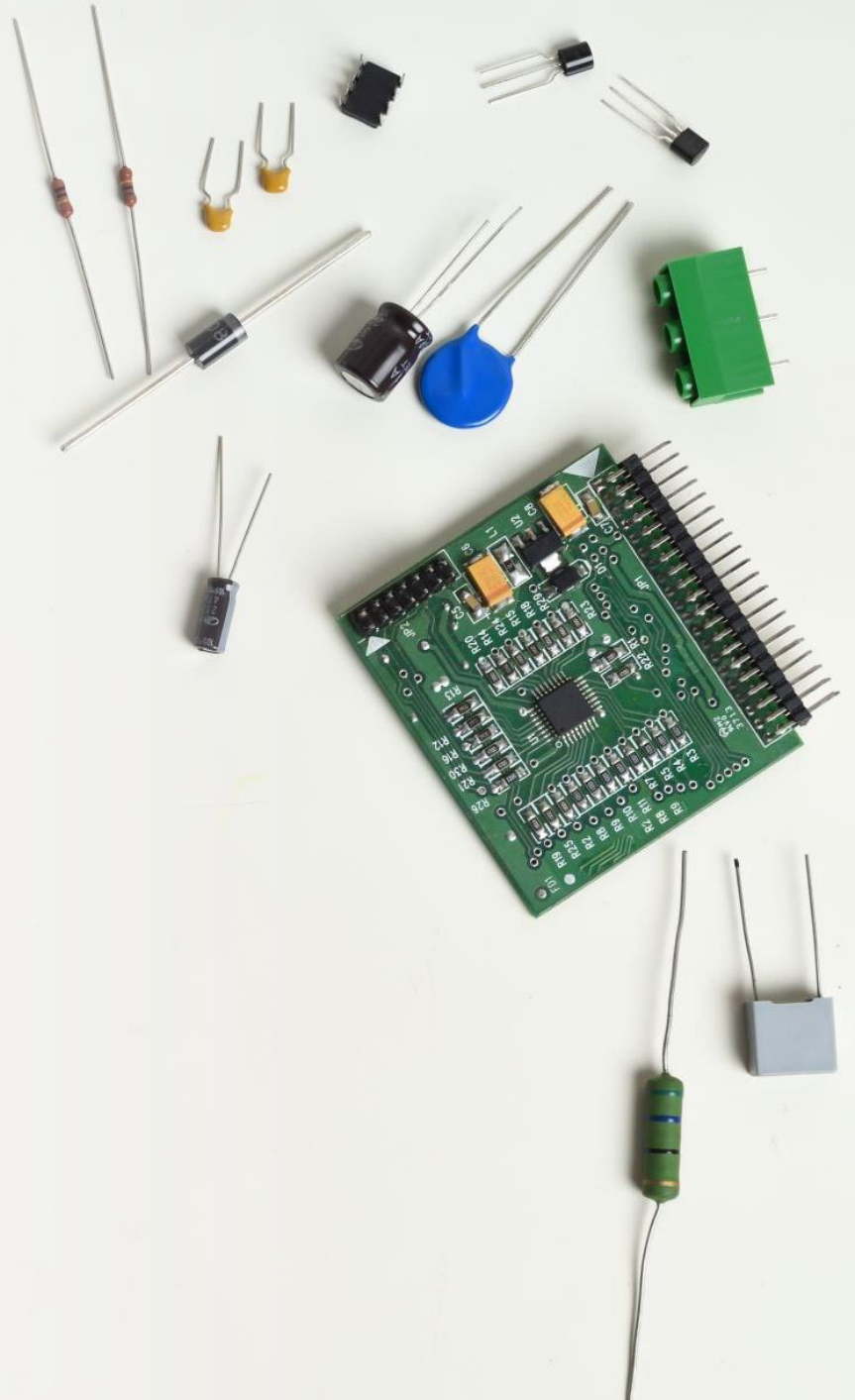


Devices Today

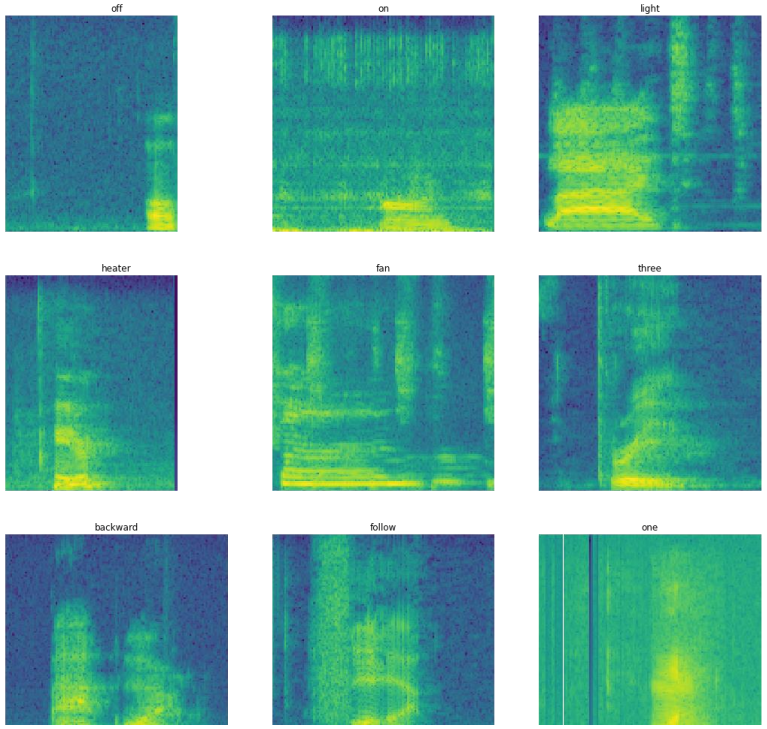
All of these have one thing in common: **They utilize the internet and depend on cloud-based servers**

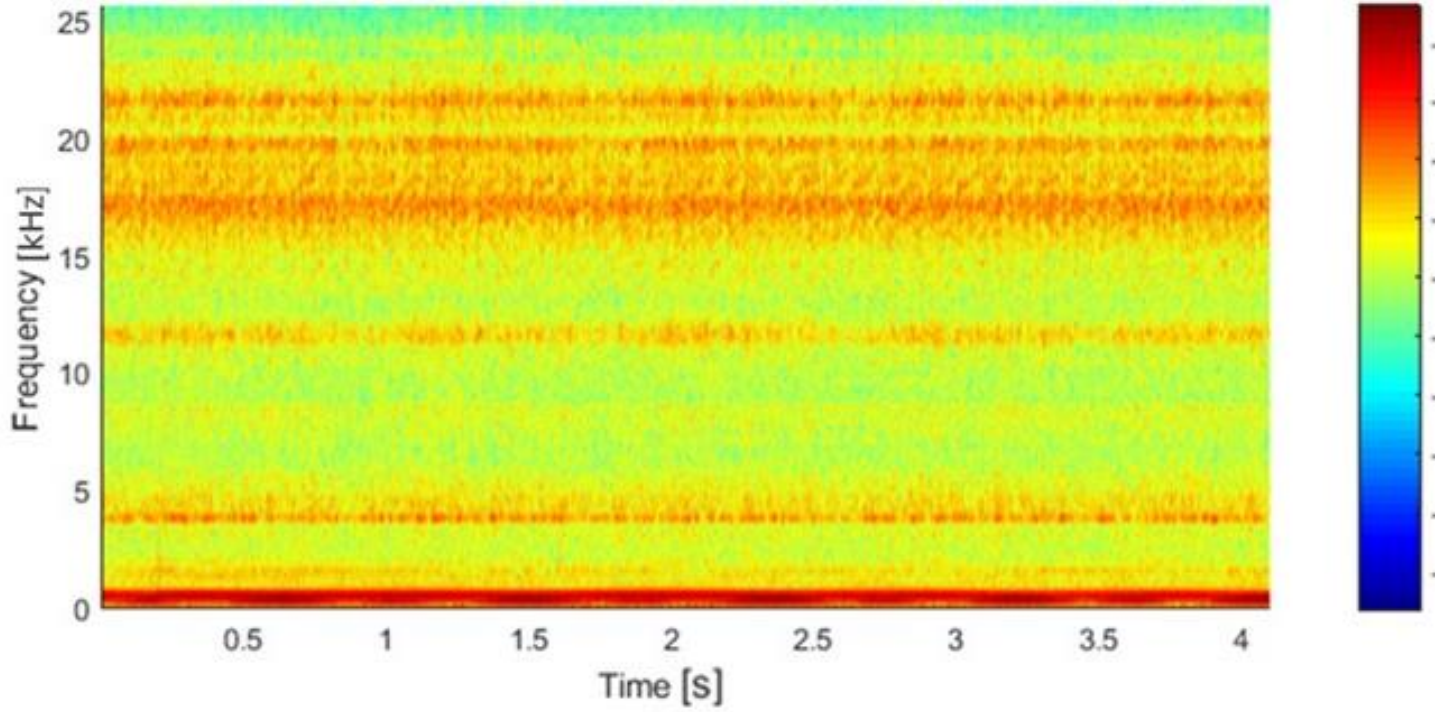
The Need for a Simple, Locally-Based Device:

- **Privacy**
- **Convenience**

Goals

- Model Trained for common Actions in houses
- Commands include ON, OFF, LIGHT, FAN and HEATER
- High accuracy voice recognition performance
- 100% self-dependent device- not requiring access to the internet/cloud

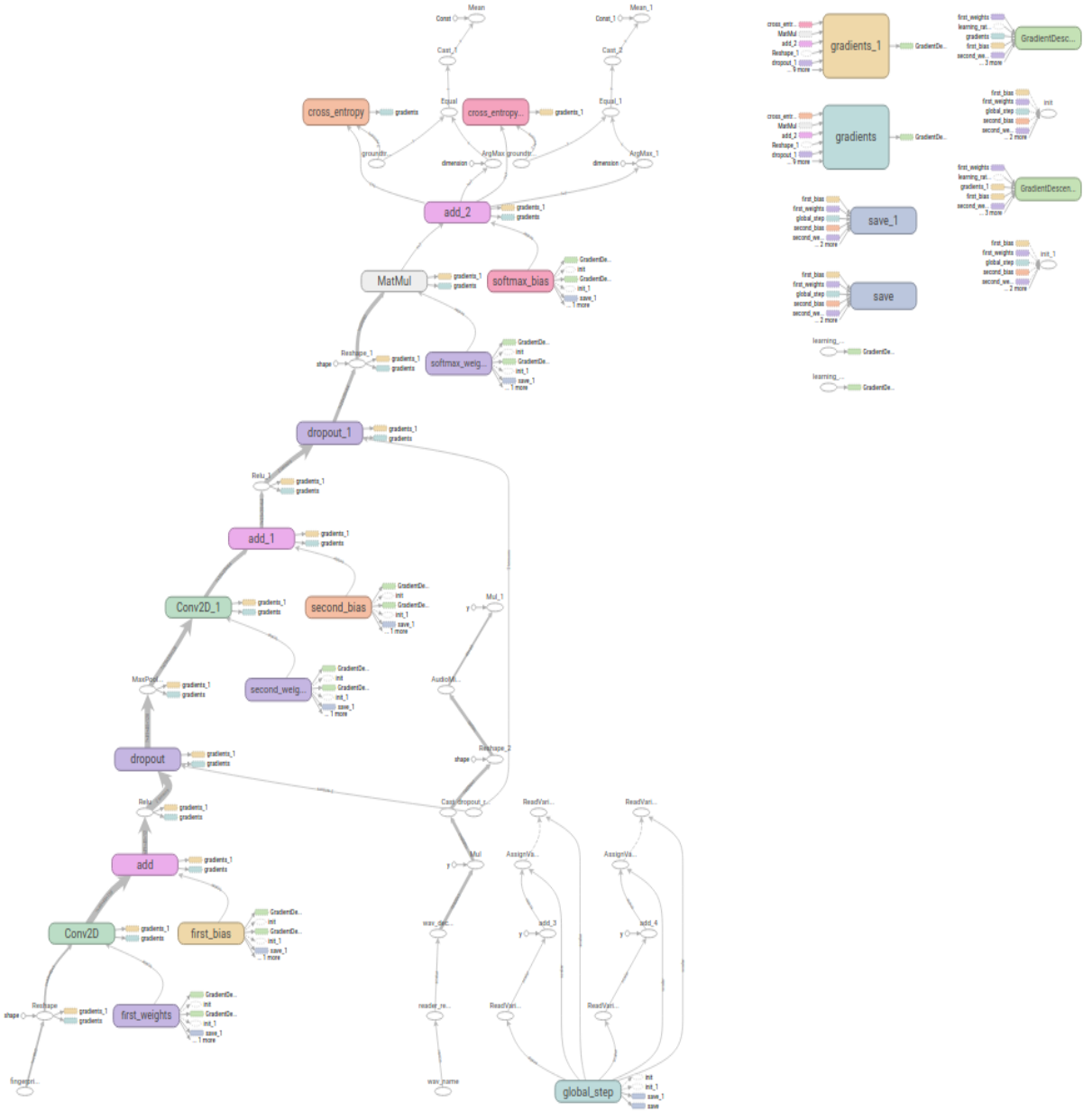




Preliminaries to the Neural Net Model: *Dataset, Preprocessing*

- TinyML recordings → 10ms Trim → OGG files
- Input Signal as frequency domain → spectrogram
  - Overlapping frames
  - Short- Time Fourier Transform
  - Filter banks
  - A Discrete Cosine Transform
  - Mel-Frequency Cepstral Coefficients

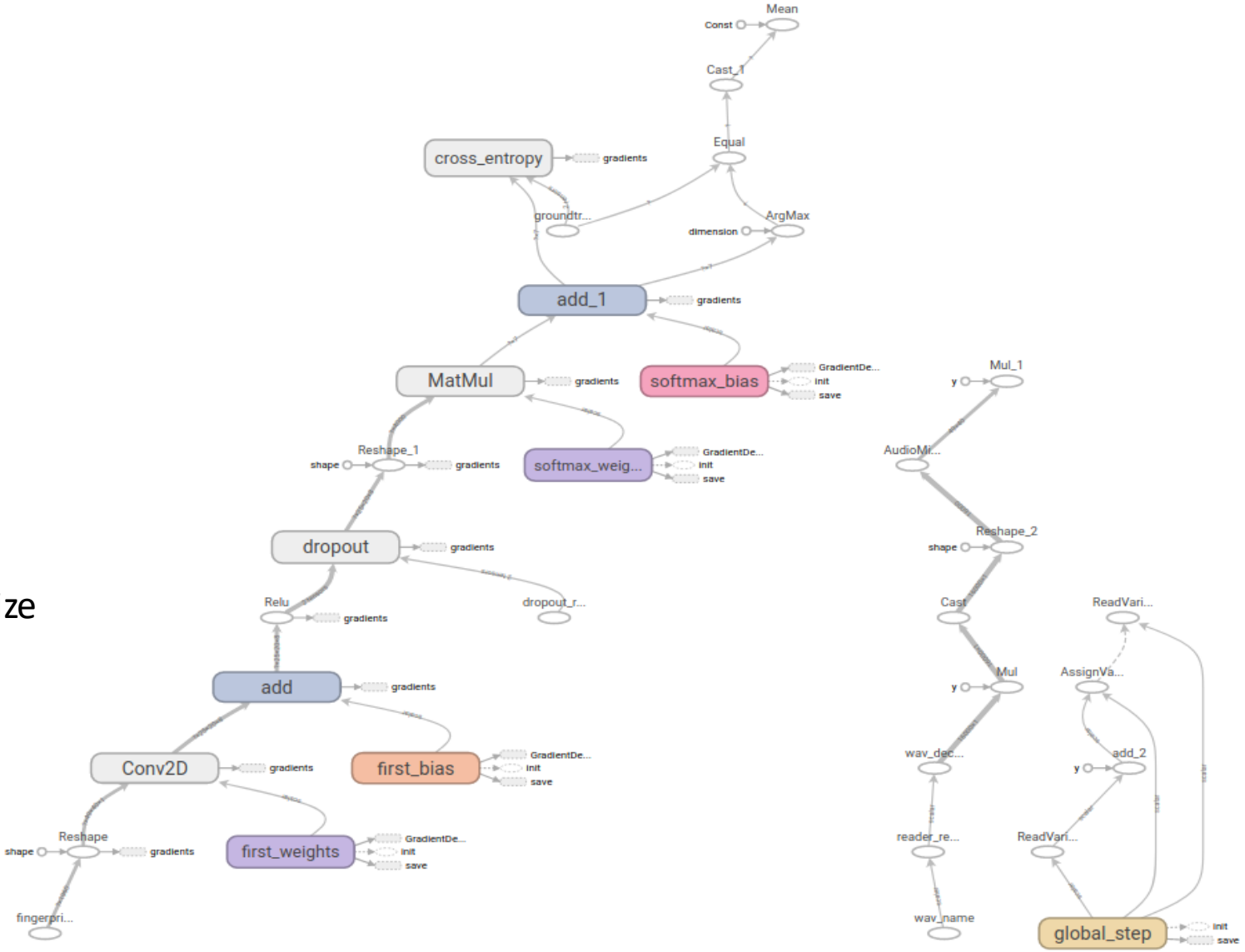
Model Layers (Large)



Results:

- Output Shape: 38 commands
- Epochs: 13,000
- Training : 94.5%
- Validation: 89.8%
- Test data: 87.7%
- Tensorflow Lite: 93% on test data
- TF Lite Size : 1574064 bytes

Model Layers(Tiny)



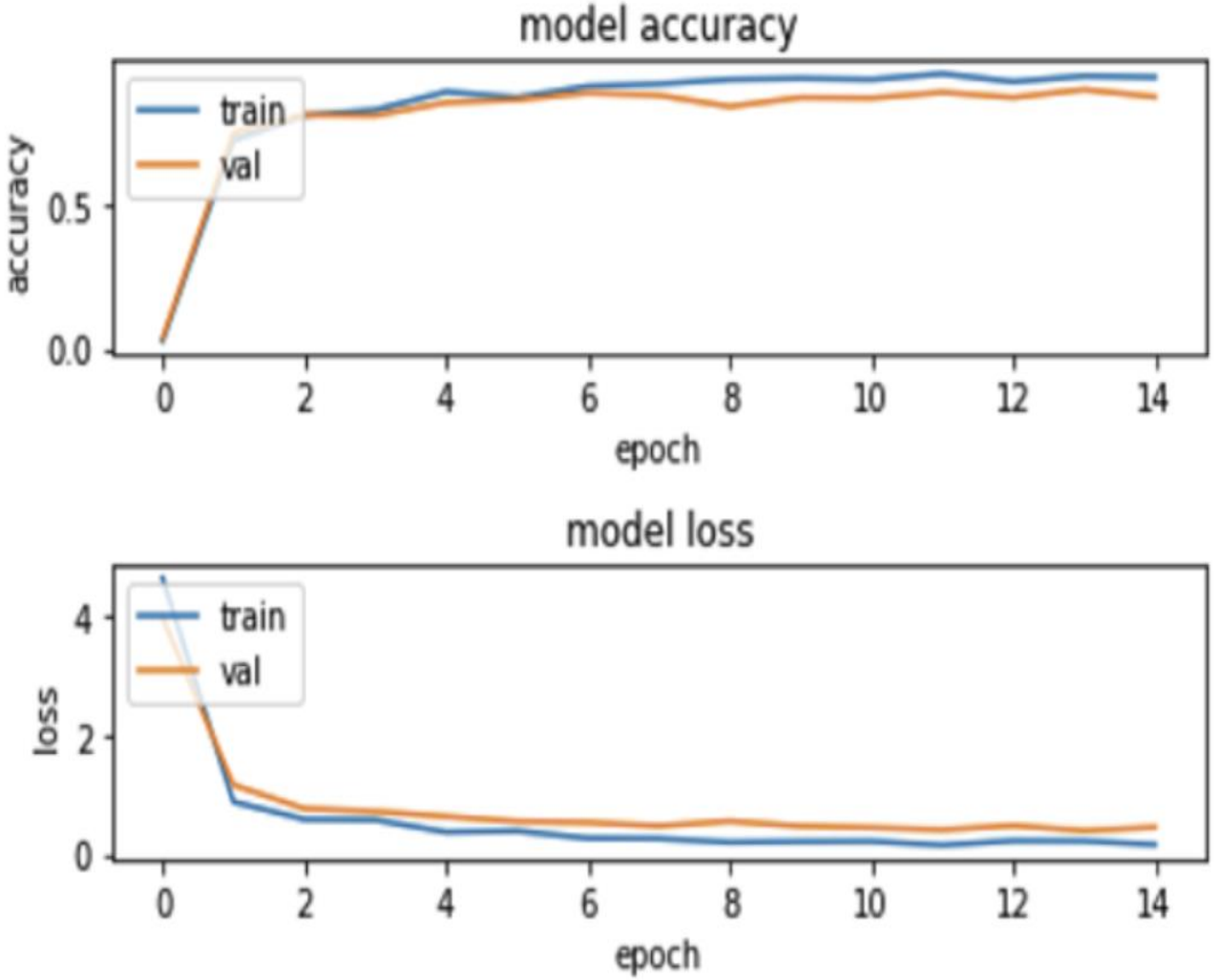
Trade-offs: Accuracy but very small size

Results:

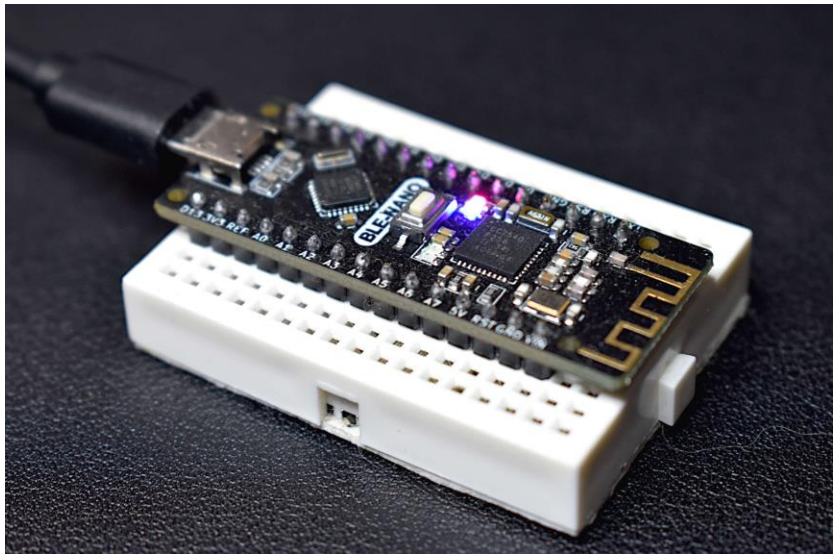
- Output Shape: 7 commands
- Epochs: 13,000
- Training : 91.4%
- Validation: 86.7%
- Test data: 85.7%
- Tensorflow Lite: 91% on test data
- TF Lite Size : 31120 bytes

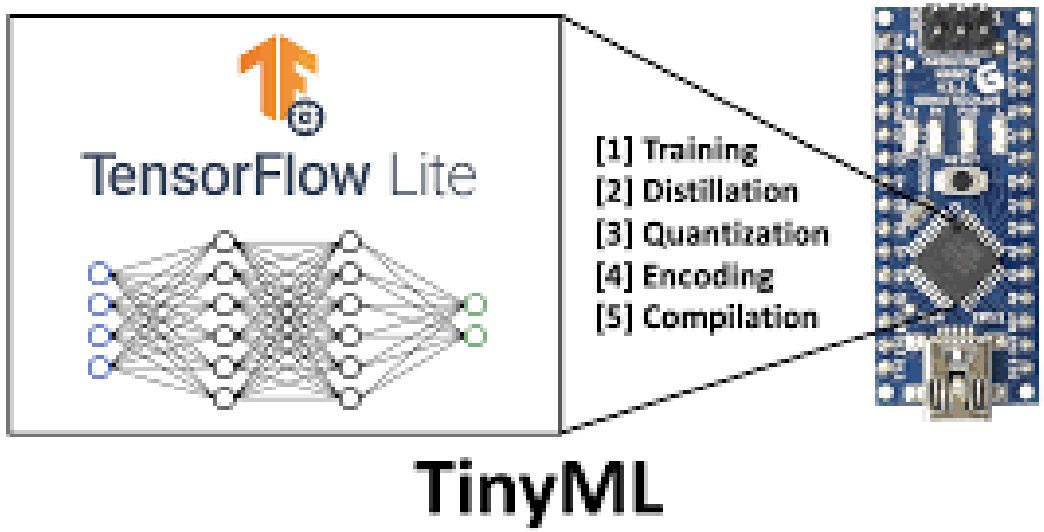
Results

- Three LEDs for LIGHT, HEATER, and FAN.
- Two commands ON & OFF to power the LEDS
- The On and OFF commands worked perfectly in powering the three LEDs.
- The LIGHT and HEATER LEDs worked perfectly.
- The FAN LED did not respond very well due to smaller data samples.



Deployment in Embedded System & Demo





[Video demonstration]