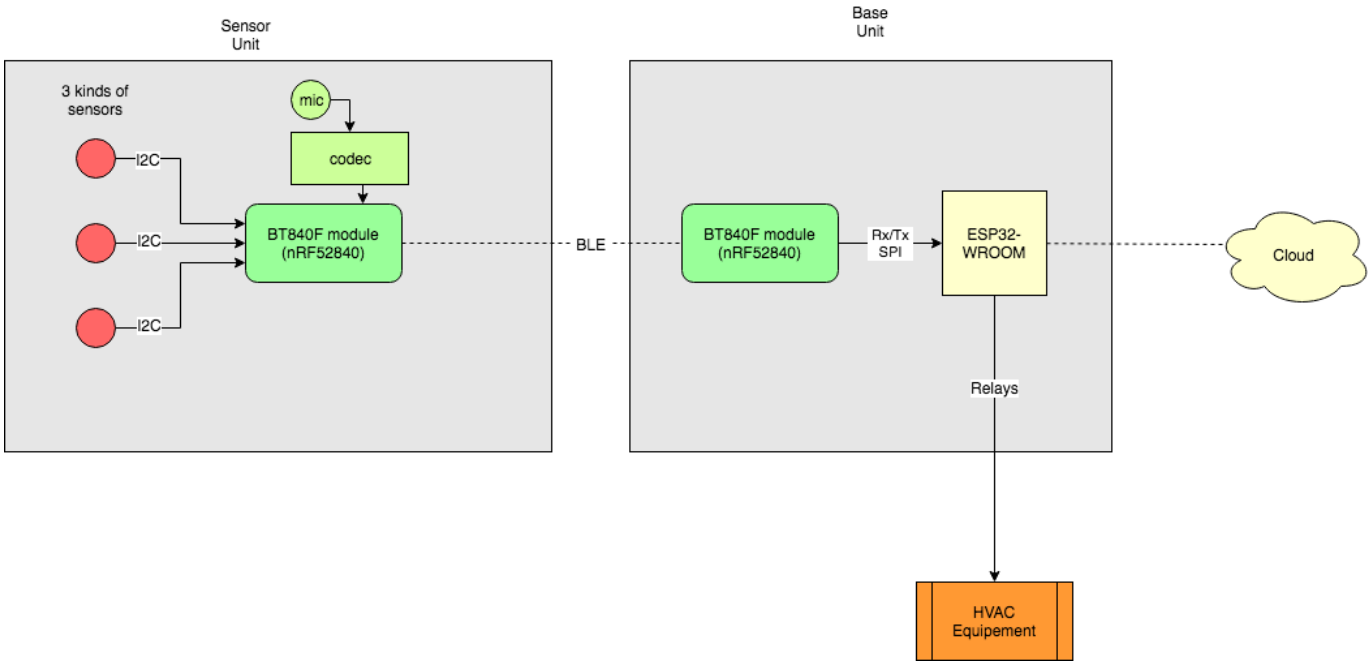
Overview of prototype function:

- Our prototype is made up of a sensor unit and a base unit.
- The sensor unit is battery-operated and communicates with the base unit using BLE5.0 (BT840F Fanstel module - nRF52840 chip)
- The function of the sensor unit, as the name suggests, is to read from multiple sensors on-board and relay this data to the base unit.
- The base unit is powered by 24VAC and communicates with a cloud service (ThingSpeak.com) using WIFI (ESP32-WROOM).
- The nRF8240 chip (onboard the base unit) communicates with the ESP32 chip via Serial comm (Rx/Tx). We also have an SPI interface.
- The function of the base unit is to control the HVAC (Heating, Ventilation and Air Conditioning) equipment by turning on/off multiple relays.
- The control code was originally meant to reside on the base unit (the ESP32 chip), however for the purposes of this winter test, the control code will be in the cloud.

Topographical view of prototype function:



SCOPE OF WORK REMAINING:

IMPORTANT NOTE:

We wish to have all testing/validation done remotely. Our hardware will remain with us and we can provide online access to connect directly with our hardware for debugging/testing/ validation. There is also Skype and other communication platforms that can be used and we can help with any additional testing steps required.

Priority 1:

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1. Fault detection and Checksum:
    - We have 2 x temperature & humidity sensors (the SHT30) and another temperature sensor (to be identified to the chosen candidate).
    - A CRC check must be performed locally to ensure the data read from each sensor is correct.
    - A CRC check must be performed for the entire sensor data packet to ensure there were no transmission errors (using BLE5.0).

Priority 2:

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2. LED driver control over I2C is required for this prototype. The code has already been completed but NOT tested. The work scope here is to simply test, debug and validate the code.
3. Powergating: Since the sensor unit is battery-operated, we have a requirement to maximize battery life. For production we are seeking a 1000 mAh battery and wish to have it last at least 6 months to a year. This is made possible by only transmitting those 80 bytes once every 5 minutes. Our powergating strategy is to shut off power completely (via transistors) to the sensors, the codec chip, led chip, and boost converter. We have individual control of each of them. The reason is as follows:
    - The sensor unit is only “woken up” when a button is pressed OR when the 5-minuter timer is completed.
    - When the 5 minute timer is completed, we wake up the sensors and boost converter ONLY.
    - When the button is pressed, we wake up the codec, LED driver, and boost converter ONLY.
    - The nRF8240 chip is powered directly and not through the boost converter.
    - The nRF8240 will go into deep sleep mode between transmissions.
    - The 5 minute timer is in the nRF8240 chip.

contd/. on page 3 …

Nice to have (to be negotiated separately):

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4. Voice solution: No work has been started on this, however the requirements are simple.
   - a button is pressed on the sensor unit,
   - a voice command (sound file) is captured (Codec control code required over SPI) and,
   - subsequently encoded (Nuvoton NAU8814 codec) and,
   - transmitted to the base unit over BLE (nRF52840).
   - transmitted to the cloud (using wifi - ESP32) for processing.
   - Note: *all speech recognition and natural language processing is performed in the cloud by a third party. This is NOT part of this work scope*.