



The finished Synapse Environmental RF Mesh Node Sensor Module.

From the top ... behind the 3M tape is the lithium battery for the precision RTC.

Next is the piezo buzzer and the digital out relay module.

The Synapse RF mesh transceiver is on the left with the carrier PCB which has the RTC.

Below is a terminal strip for the moisture sensor and emergency switch/window or door contact.

To the right, is the two power cords (one for the RF mesh and the other for the PIR sensor)

Also, all the analog sensors are externally exposed from the screw less snap together enclosure for easy cleaning.



On the outside of the snap enclosure is the very reliable Visonic PIR pet immune motion sensor. Embedded in colorful silicon clay (Surgu) is the temperature sensor (blue), humidity sensor (yellow) light sensor (red) and the panic/ emergency push button (black). On top is my calibration reference module for my analog sensors.

For the Synapse Environmental Universal Mesh Node , we tried to find the most inexpensive (dirt cheap), reliable, low voltage sensors (3.2-3.3 v) The trick, in using these dirt cheap sensors, is to average the input count and to use a calibration standard (humidity/temperature module) for a known reference to add this calibration offset constant for the sensor calibration.

Note: These same, low cost, sensors can be easily applied to the "low voltage" 3 V GPIO on the Maximite/DuinoMite.

Sensors and components used in Synapse Environmental Universal Mesh Node:

1. Temperature - Microchip MCP7900A +- 4 C (Analog)

Design note: No averaging needed on the Synapse RF module but any other micro-controller you would probable need it. The accuracy of +-4C is not great, due to low cost, (\$0.34 USD) but the trick using a temperature reference with a calibration offset constant then you can easily make this analog sensor read +-1 F.

2. Humidity - Honeywell HIH-5030 SMT (Analog)

Design note: Wires can be easily attached to this low cost analog surface mount humidity sensor.

Count averaging is required for stable and precision readings.

Humidity sensor is sensitive to light --> shield sensor hole opening from direct light sources.

Calibration offset constant is also use and this humidity sensor needs to be calibrated to a known humidity reference. We found that I can produce a +-1 RH% error when compared to a Sensiron digital SHTx "gold standard" humidity sensor.

3. Moisture sensor - SeeedStudio (Analog + digital out enable/disable)

Design note: This is probably the most inexpensive moisture sensor we have found to date. The SeeedStudio wiki data says the electronics, on this sensor, is not protected from water (a 2N2222 transistor with a collector pulldown and the base tied to one probe and the other probe is tied to ground) I just coated the surface mount components with "liquid tape or rubber and used silicon tape around the whole connector area to seal the sensor from water invasion. In software, I used a digital out to supply power to the VCC for the sensor. By turning this digital output on/off, with a long time span, should decrease the electrolysis/corrosion due to a constant polarity on both probes. The analog count reads 0 with no moisture and increases in the 100's for moisture and or water.

4. Digital output relay - SeeedStudio

Design note. This relay VCC, for the coil, needs 5 VDC which I have before my 3 vdc regulator. It even has a LED for relay activation indication. I used this same very reliable relay to pulse my garage door. In this module, We use it as a low signal output relay (for blinds and drapes)

5. Ambient Light Sensor - Sharp GA1A2S100SS.(Very sensitive - mimics the human eye)

Design note: I used a 10K pulldown on the signal output for proper analog conditioning on the adc input.

6. SeeedStudio PIR miniature motion sensor.

Design note: We tried several of the SeeedStudio PIR miniature motion sensors and by bench testing thoroughly, the reliability was not there due too many false PIR sensor triggers. I switched from this "hobby grade" PIR motion sensor and bought a commercial professional engineered PIR motion from Visonic (\$12 USD).

This inexpensive model I bought was the miniature ViPet (Pet-immune) and has the following specs:
40' by 40' coverage (12x12 meters)
60 lbs Pet immune (27 kg)
Walk test LED (can be disabled)
High reliable dual count event trigger
Tamper switch.
80x50x37 mm <----- Very small
9-12 VDC operation at 9 ma

Summary:

Synapse Environmental Universal Mesh RF Node has the following sensors and functions:

1. PIR motion sensing (digital) --> security and occupancy sensor
2. Temperature sensor (analog)
3. Light sensor (analog)
4. Humidity sensor RH% (analog)
5. Moisture sensor (analog) --> water moisture detector (it can be also be used for household plants)
6. Security switch input --> from magnetic door or window sensors or emergency pushbutton switch
7. Precision RTC with lithium backup
8. Piezo beeper
9. Digital output relay capable of 10 amps @ 110 VAC. (Used for blinds / drapes or low voltage control)

Having all the above sensors in one universal mesh node module is a very convenient way to monitor everything in one room "environment". Multiple distributed Synapse Environmental Universal RF Nodes could be added to each room for the greatest RF sensor coverage.

BTW ... my next door neighbor is trying to obtain magnetic connectors from "littlebits" toys in which only the necessary needed sensor could be easily plugged into the environmental universal sensor enclosure. <-----<<<< very cool. !!!!