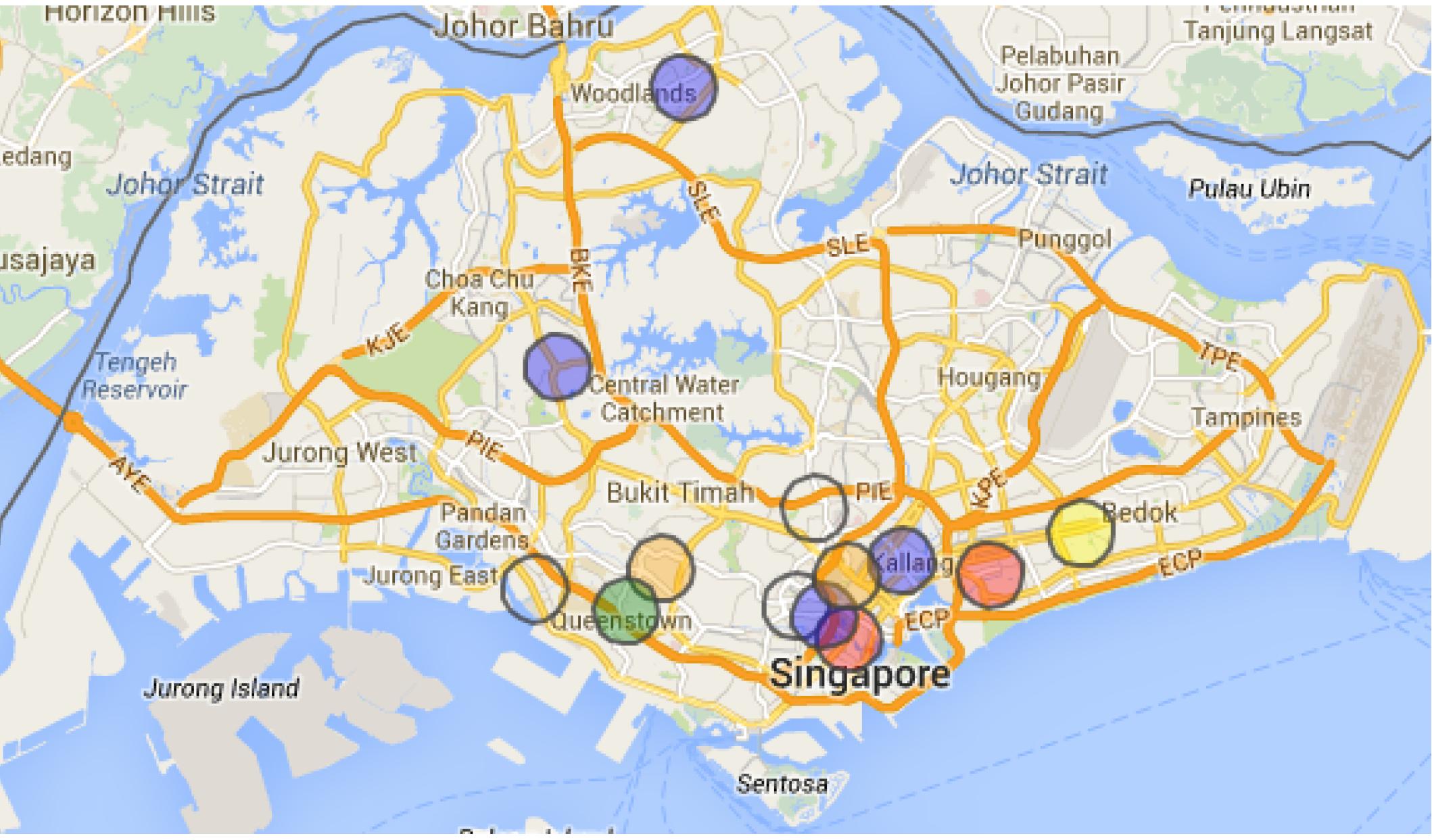
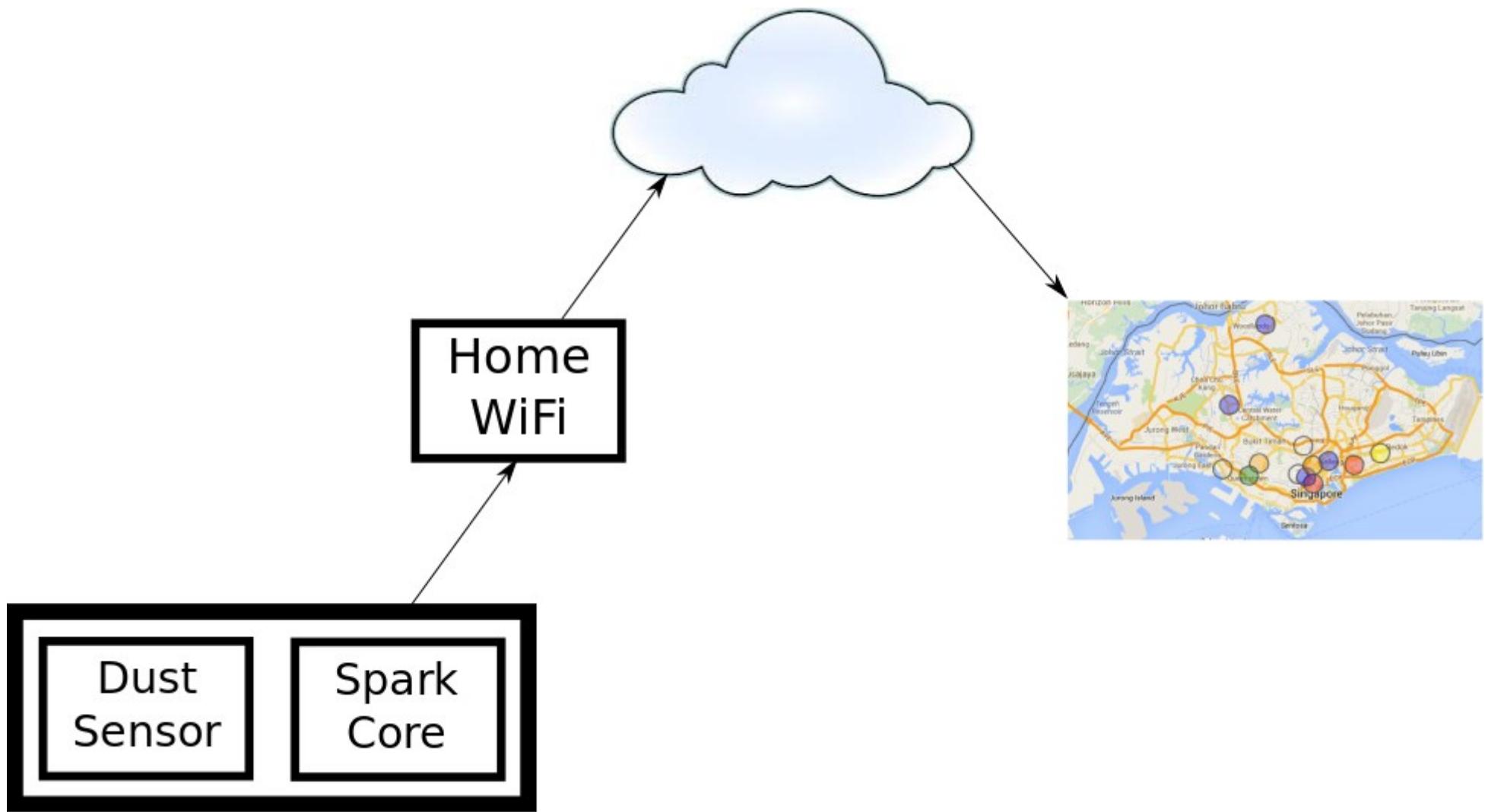


# YAH! Crowd-Sourced Haze-Mapping









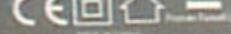
Yahi Sensor #020

SWITCHING  
POWER SUPPLY

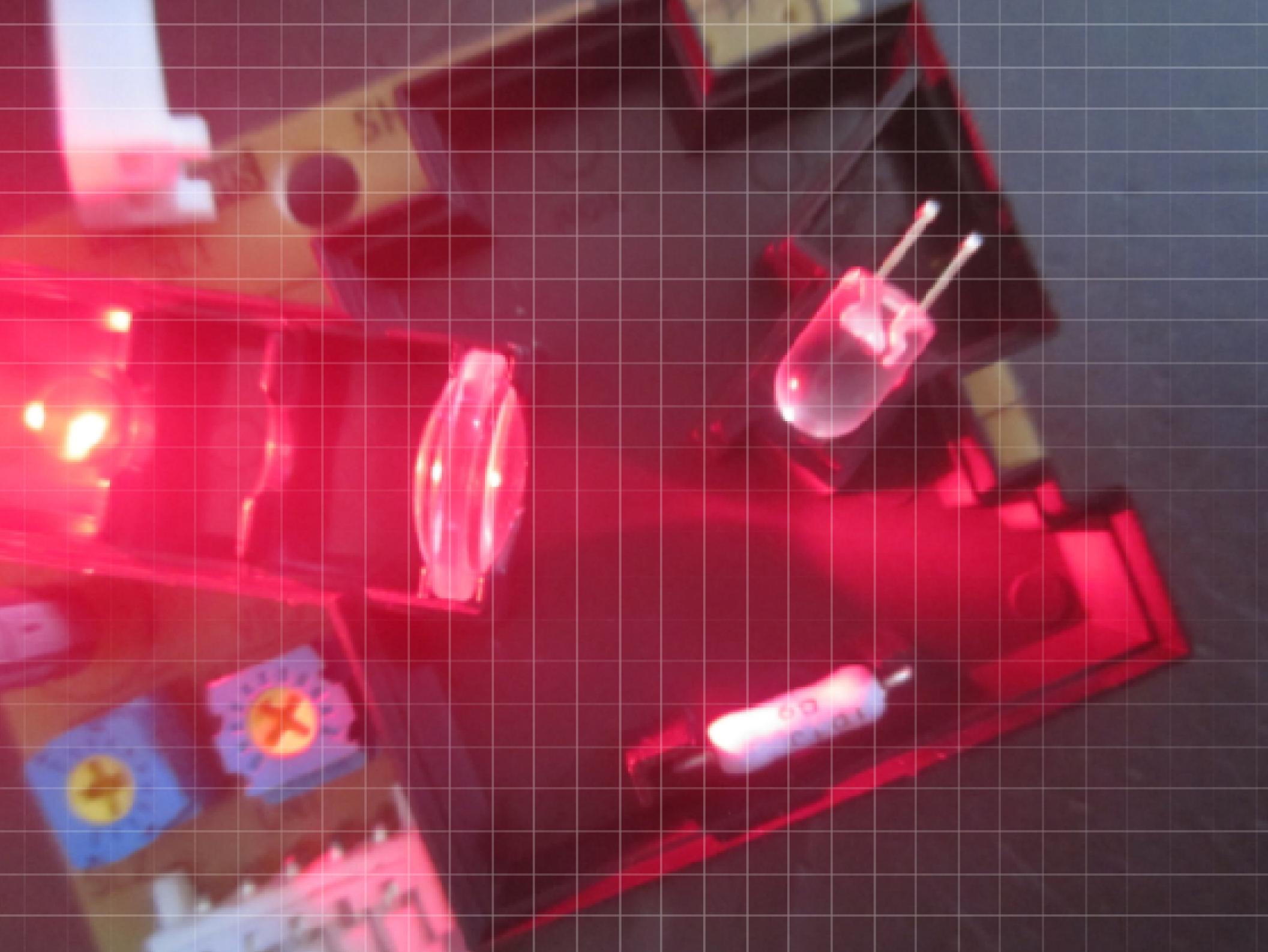
MODEL M602830K  
PRB 150 240V~45/50Hz 210mA

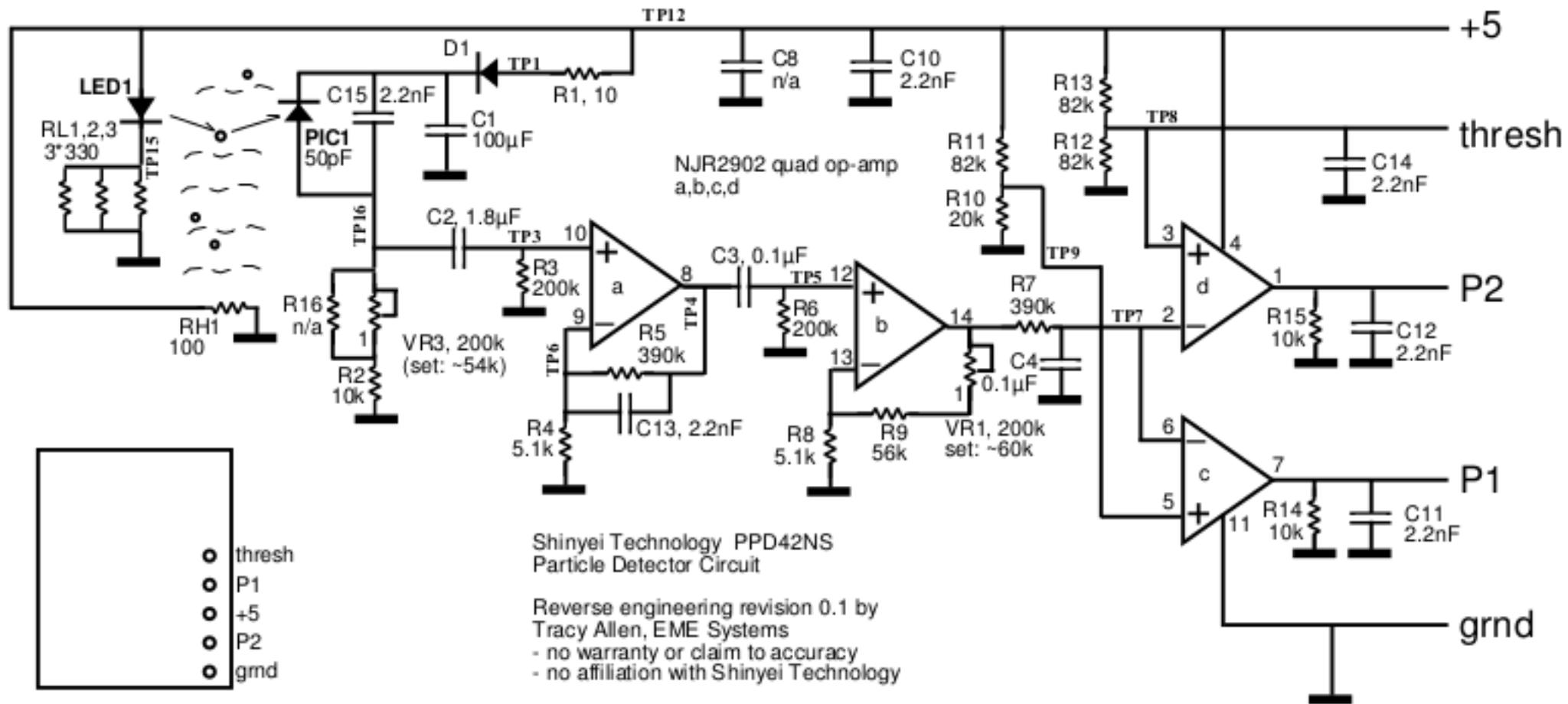
AC 24V 210mA

LTE Power Supply

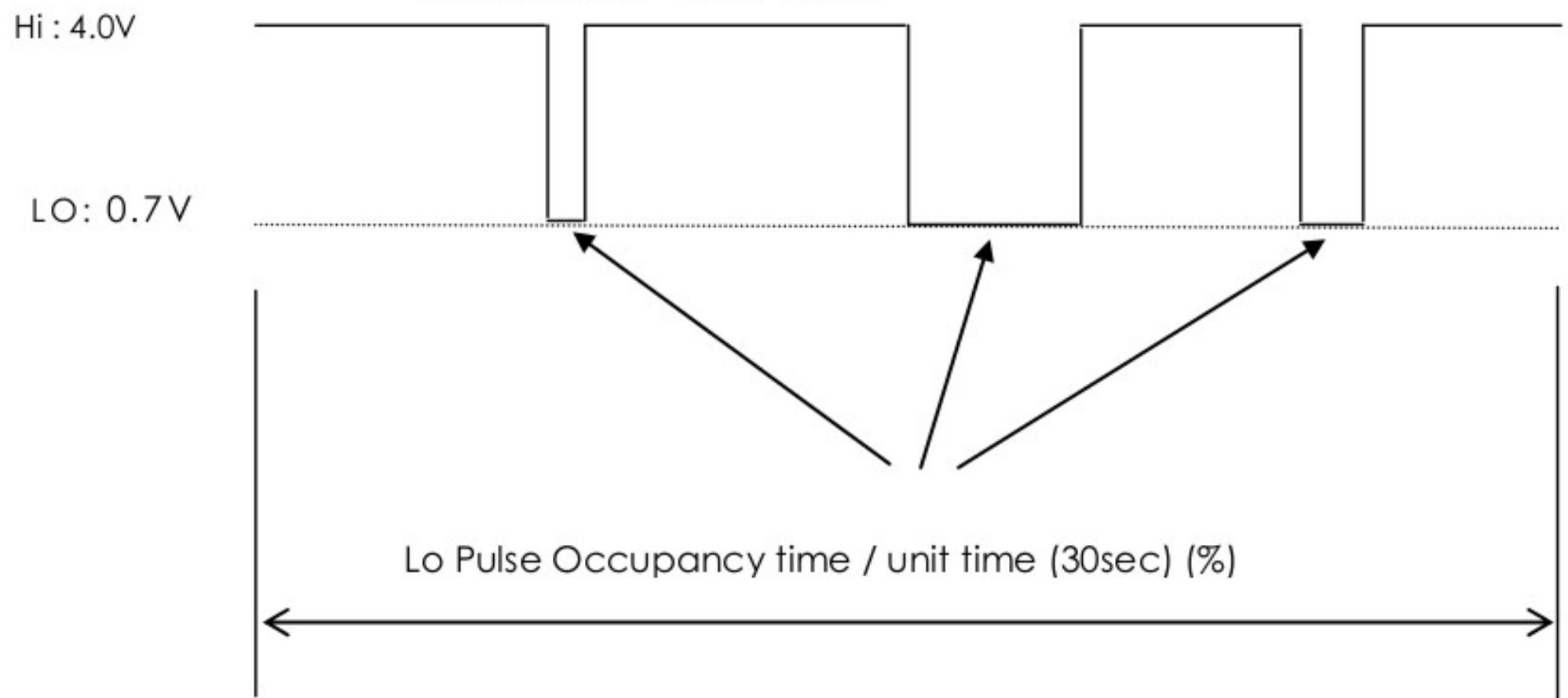




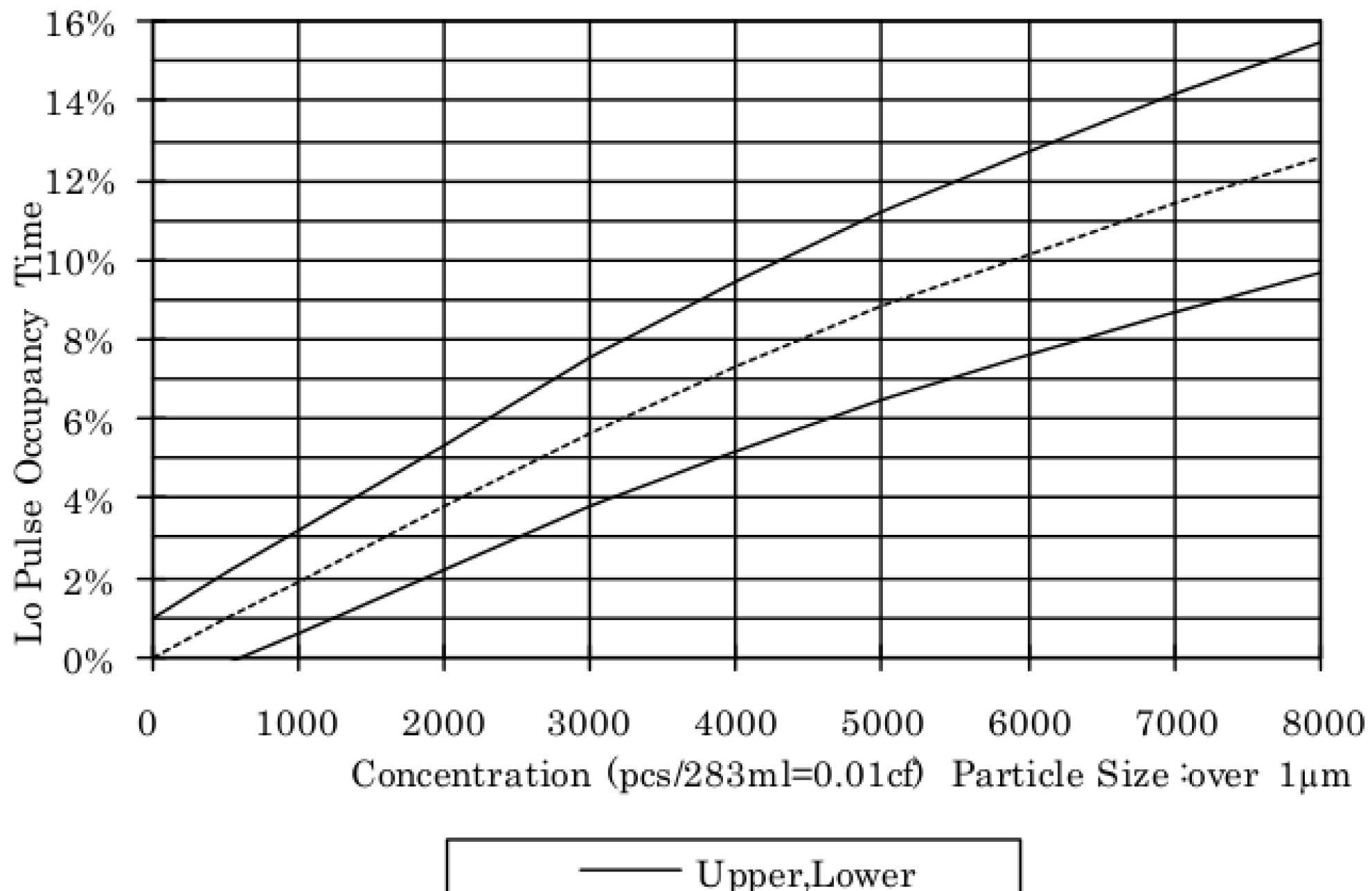




PULSE WIDTH = 10ms~90ms



## Smoke(Cigarette)-Output P1 Characteristics



```
void loop() {
    duration = pulseIn(pin, LOW);
    lowpulseoccupancy = lowpulseoccupancy+duration;

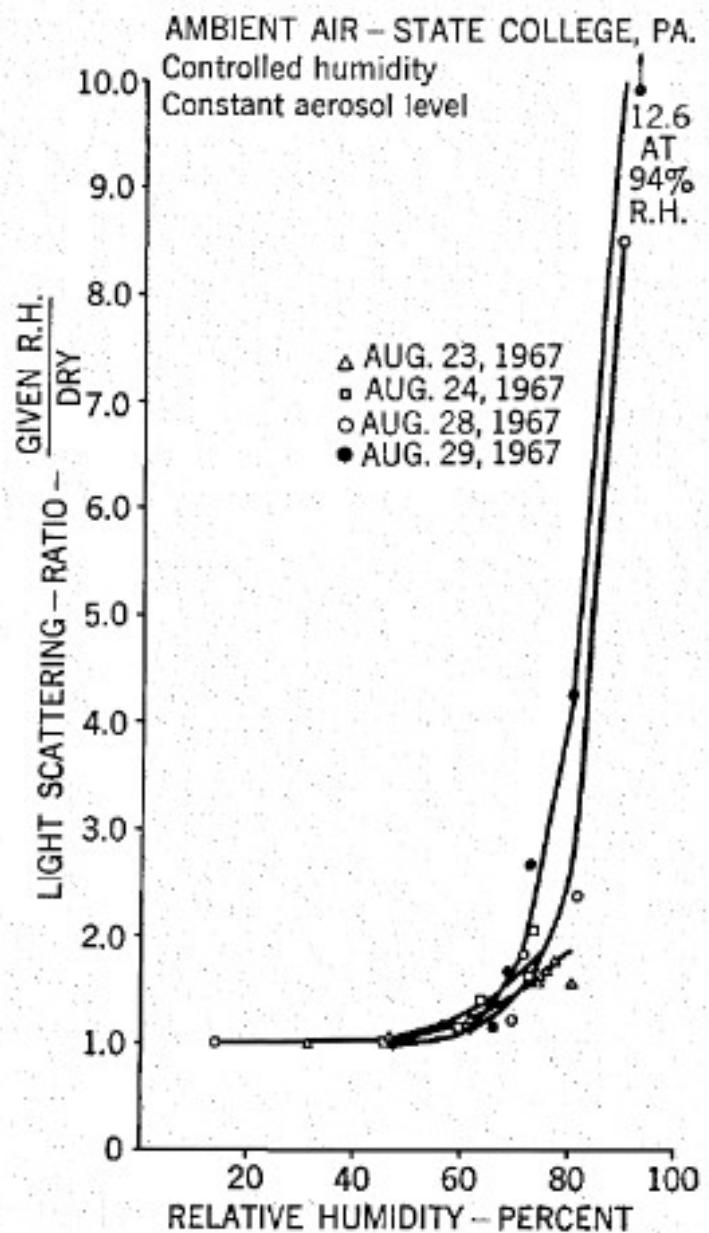
    if ((millis()-starttime) > sampleteime_ms)//if the sampel time == 30s
    {
        ratio = lowpulseoccupancy/(sampleteime_ms*10.0); // Integer percentage 0=>100
        concentration = 1.1*pow(ratio,3)-3.8*pow(ratio,2)+520*ratio+0.62; // using spec sheet curve
        Serial.print(lowpulseoccupancy);
        Serial.print(",");
        Serial.print(ratio);
        Serial.print(",");
        Serial.println(concentration);
        lowpulseoccupancy = 0;
        starttime = millis();
    }
}
```

```
$ curl -sS --no-buffer 'https://api.spark.io/v1/events/yahi?access_token={accessToken}' | grep --line-buffered {devi  
data: {"data": {"lpo: 181590, r: 0.605300, c: 314.227692 }", "ttl": "60", "published_at": "2014-07-30T02:26:16.236Z", "co  
data: {"data": {"lpo: 39560, r: 0.131867, c: 69.127106 }", "ttl": "60", "published_at": "2014-07-30T02:26:50.753Z", "core  
data: {"data": {"lpo: 0, r: 0.000000, c: 0.620000 }", "ttl": "60", "published_at": "2014-07-30T02:27:25.876Z", "coreid": "
```

```
estimatedPm25 = 0.0889 * averageConcentration - 1.69
```

- Approximation!
- Extrapolation!

```
(estimatedPm25 <= 12.0) ? "green" // Good  
: (estimatedPm25 <= 55.0) ? "blue" // Moderate  
: (estimatedPm25 <= 150.0) ? "yellow" // Unhealthy  
: (estimatedPm25 <= 250.0) ? "orange" // Very Unhealthy  
: "red" // Hazardous
```



	<b>PSI Measurement</b>	<b>Yahi Project</b>
<b>Objective</b>	human health impact of airborne pollutants	mapping the location and movement of haze
<b>Accuracy</b>	high (lab-grade instruments, operated by experts, years of research)	<b>limited</b> (consumer-grade dust sensors, unsupervised operation, <b>very limited dataset for current PM2.5 estimation</b> )
<b>Measurement Period</b>	24 hours (sometimes shorter)	30 seconds <b>(noisy data with very high spikes)</b>
<b>Pollutant Scope</b>	particles, SO <sub>2</sub> , CO, O <sub>3</sub> , NO <sub>2</sub>	particles only
<b>PM2.5 Assessment Approach</b>	<ul style="list-style-type: none"> <li>• collect particles smaller than 2.5 microns for 24 hours</li> <li>• weigh them</li> <li>• <b>measure PM2.5 accurately</b></li> </ul>	<ul style="list-style-type: none"> <li>• count approx 1 micron particles for 30 seconds <b>(particles smaller than 1 micron are not detected)</b></li> <li>• <b>estimate PM2.5</b> based upon historical correlation between Yahi counts and <a href="#">NEA PM2.5 measurements</a></li> </ul>

# Lessons Learned

- NEA is reasonably supportive
- Immature devices
- Finding appropriate volunteers was difficult
- Measuring 1 $\mu$ m proxy works



Parameter	RC17xxHP-RC232	Unit
Frequency bands	169/433/444/458/463/467/868	MHz
Data rate	1.2 -100	kbps
Max output power	+ 27 dBm	dBm
Sensitivity, (1.2 kbps)	-118	dBm
Supply voltage VCC	2.8 – 3.8	Volt
Supply voltage Internal PA	VCC_PA*	
Current consumption, RX /IDLE	31,7	mA
Current consumption, TX (+27 dBm)	407	mA
Current consumption, SLEEP	Max 2.0	uA
Temperature range	-30 to +85	°C

\*Voltage range on VCC\_PA depends on module variant.

# Status, Next Steps, Help

- 10-12 sensors operating
  - Aiming for 50-60 this year, good coverage
  - Archival data, live feed, API
  - Publish backend source
  - Add humidity sensors, mesh modules, battery and charger
- 
- Data viz
  - Mobile apps

<http://rolandturner.com/yahi>

