

Demo: Handheld Particulate Matter Measurements with COTS Sensors

The Tenth International Conference on Pervasive Computing (Pervasive 2012)

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1. Identification of a suitable dust sensor

- Several candidate sensors (also see Fig. 1):

Sensor	Size	Range	Power	Retail Price
Sharp GP2Y1010	46x30x18 cm ³	0 – 0.5 mg/m ³	0.1 W	~ 10 \$
SYHitech DSM501	59x45x20 cm ³	0 – 1.4 mg/m ³	0.45 W	~ 10 \$
Shinyei PPD42NS	59x45x22 cm ³	0 – 800,000 pcs/ft ³	0.45 W	~ 200 \$
Shinyei PPD60V	88x60x22 cm ³	0 – 2,000,000 pcs/ft ³	0.7 W	~ 420 \$
Shinyei AES-1	90x90x23 cm ³	300 – 300,000 pcs/ft ³	3.6 W	~ 1,100 \$
NIDS PSX-01E	59x45x20 cm ³	0 – 2.0 mg/m ³	0.15 W	n/a
NIDS PS02C-PWM	n/a	0 – 2.0 mg/m ³	n/a	n/a

- Best fit: Sharp GP2Y1010 (small, low-cost, low-power, available, and orientation independent).

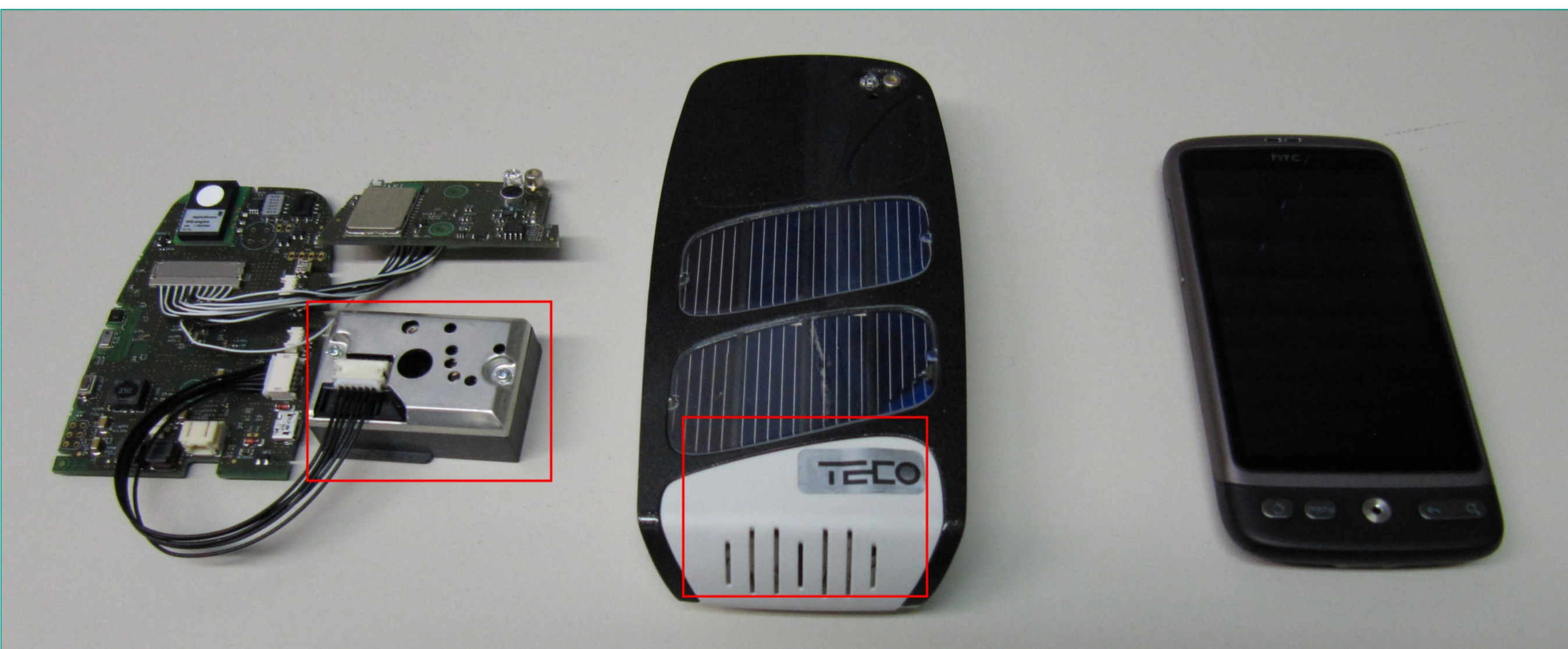


Fig. 2: The TECO Envboard, with Sharp GP2Y1010 dust sensor.

3. Experiments and Conclusions

- Few suitable COTS sensors available
- Experiment: Comparison of GP2Y1010 and gauged TSI Dusttrak DRX 8533 aerosol monitor
- Readings of both devices correspond, but GP2Y1010 is noisy and requires calibration
- Mobility offers increased spatial and temporal resolution compared to standard PM measurement techniques
- Margin of error is still high when data is unprocessed

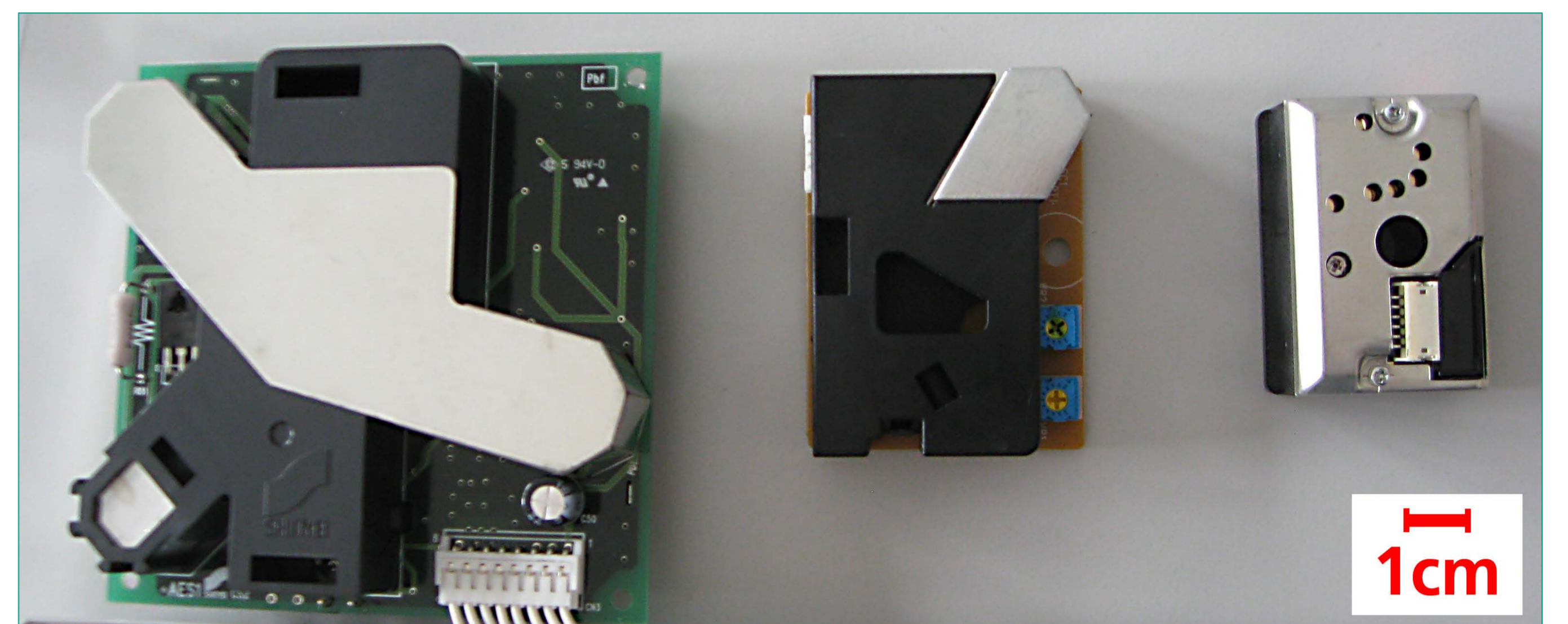


Fig. 1: COTS dust sensors: AES-1, DSM501, GP2Y1010 (from left).

2. Handheld platform: The TECO Envboard

- Mobile sensing platform for research and development purposes (see Fig.2)
- Plethora of sensors, ranging from environmental (temperature, humidity, barometer, UV, ambient light, **dust**, noise levels) over gas (CO, VOC, O₃, NO₂) to activity (acceleration, compass, gyroscope)
- Used standalone or with host over Bluetooth
- Application scenarios include *Participatory City Sensing*, *worker safety / alert systems*, *exposure / life log*, and *activity / context recognition*

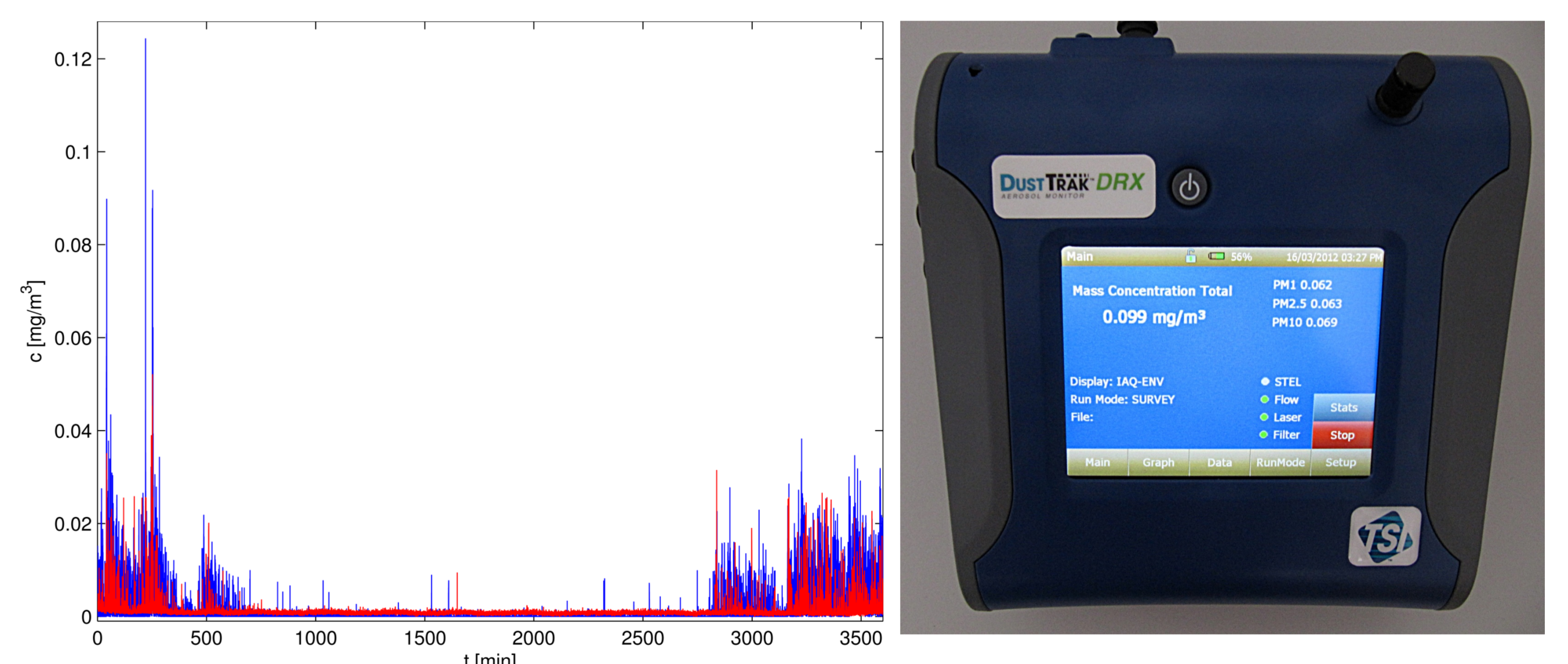


Fig. 3: Left: Processed measurement of the GP2Y1010 (red curve) and DRX 8533 (blue). Right: TDI Dusttrak DRX 8533.

