

Home Assistant For Weather Monitoring

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February 2025





Previously ...



- Khalid: IoT and Microcontrollers (Oct 2018)
 - MicroPython, MQTT, Home Assistant
- Tim Laurence (Apr 2024)
 - Sensors: Presence, Humidity
- Khalid: Indoor Climate (Nov 2024)
 - Humidity, CO2, VOC, Radon
 - InfluxDB for data storage
 - Grafana for visualization





Agenda



- Weather Stations
 - Acurite
- Thunder Storms
- Integrating rtl_433 with Home Assistant
- Weewx weather application





Weather Stations



- Provide outdoor condition in real time
- In effect, a weather proof housing + sensors
- At a minimum
 - Temperature, Humidity
- Depends on features and cost:
 - Wind speed (anemometer)
 - Wind direction (weather vane)
 - Rain (rain bucket)
 - Solar radiation (luminance)
 - Lightning strikes





Weather Stations



- Typically come with an indoor display
- Has indoor temperature and humidity
- Often atmospheric pressure as well
- Some offer 'cloud' connectivity





Cost vs. Features



- Either high end (too expensive), or too basic
 - Davis
 - RainWise
- Good balance
 - AcuRite
 - LaCrosse
- Others
 - Oregon Scientific
 - Explore Scientific/Bresser
- Kijiji / Marketplace, sometimes good deals





Limitations



- Rain gauge does not detect drizzle
 - Bucket tip threshold
- Snow/ice not detected
 - (only as rain when melting)
- Placement important for some measurements
 - Wind speed, wind direction





Online Stations



- Many ways (APRS amateur radio, ...)
- Wunderground
 - Was U Michigan, then Weather Channel, IBM, private equity)
- Network of 250k Personal Weather Stations (PWS)
- Hoarding user contributed data
- Used to have an API for data, then closed it off.





Demo



- Personal Weather Station (PWS) buying guide
- <https://www.wunderground.com/pws/buying-guide>
- Example station
- <https://www.wunderground.com/dashboard/pws/IWATER94>





Example



- Explore Scientific 7-in-1
- Temperature, Humidity, Rain, Wind direction, Wind speed, UV, Solar radiation
- \$450 !!!
- 5-in-1 \$200

Explore Scientific Deluxe Professional 7-in-1 Outdoor Weather Station with Weather Sensor Array

Model: Delux **Web Code:** 17956445



BEST BUY Sold and shipped by Best Buy



\$449.99





AcuRite “Tower”



- Temperature and Humidity
- Outdoor, but not waterproof
- Comes with some displays
- Buy used for ~ \$10, or \$20 with a display
- Good indoors as well
 - Used it for basement





AcuRite 3n1



- Temperature, Humidity, Wind Speed





AcuRite Iris 5n1



- Adds Wind direction, and Rain

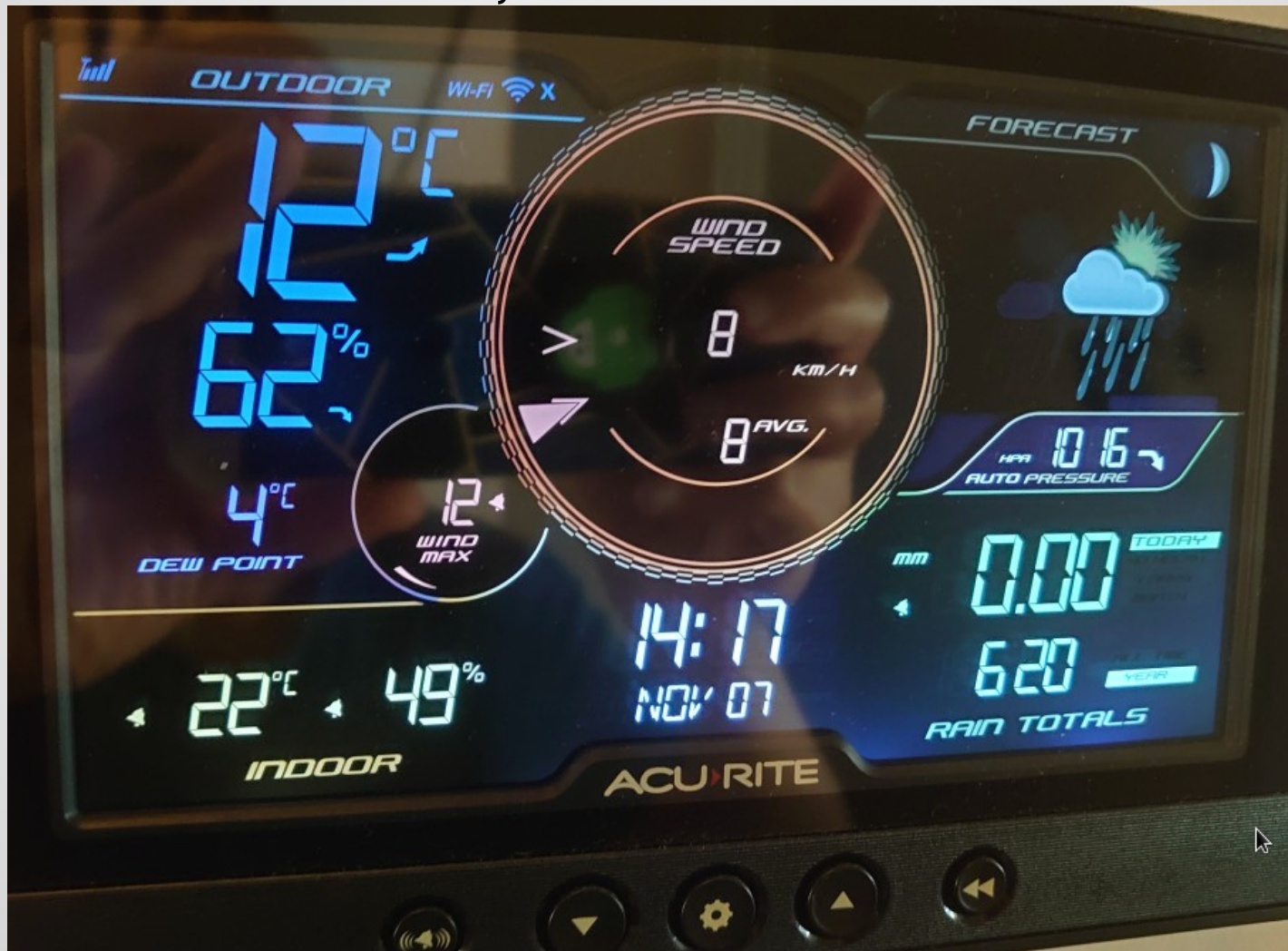




Display



- Various models, this is one of them





Remote Battery

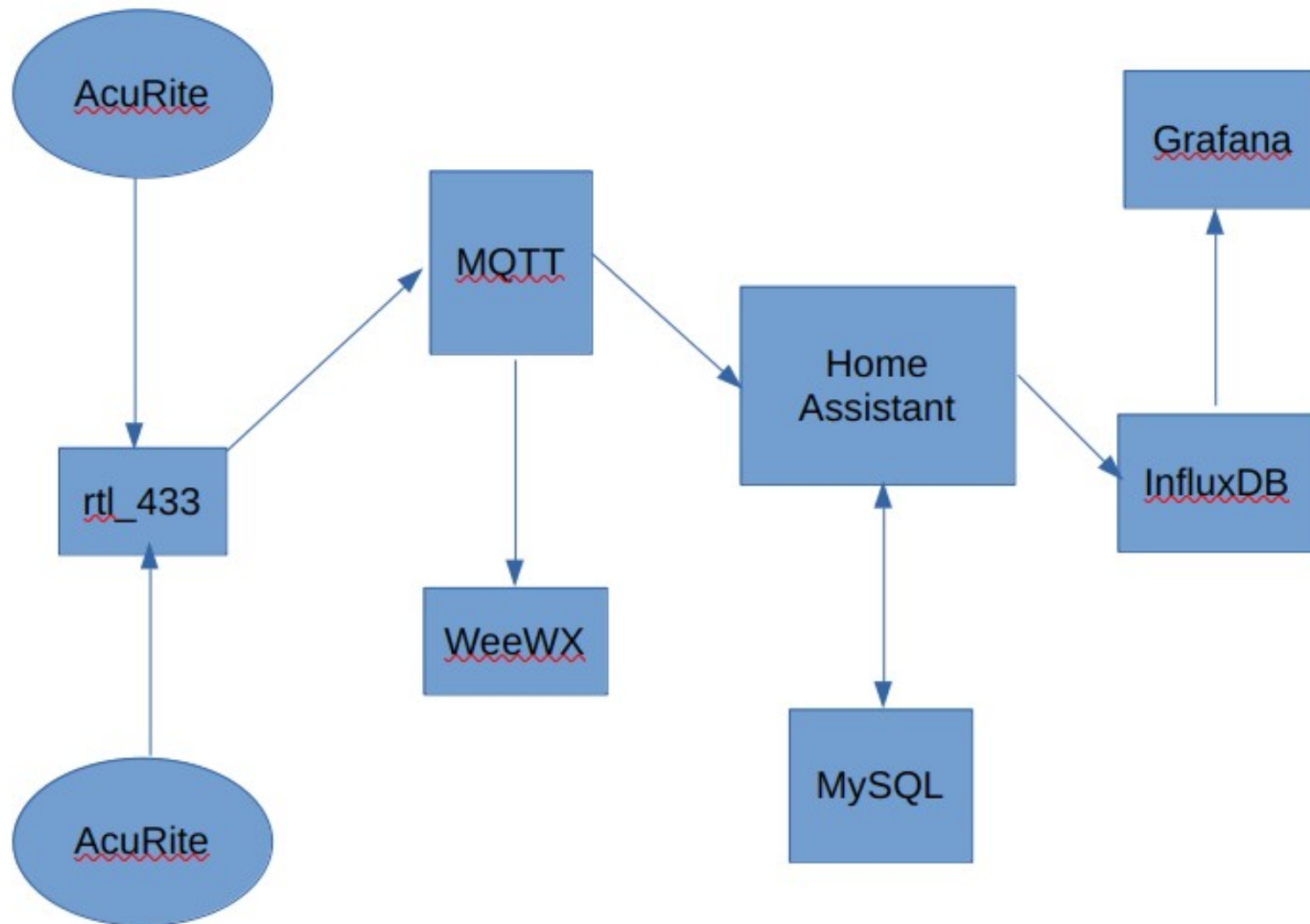


- Long power cable
- Keeps batteries at ground level
- For easy replacement, if sensor is on roof





Components





RTL SDR



- SDR = Software Defined Radio
- Several models (eBay, Amazon, ...)
 - RTL2832U ~ \$30
- Useful for other things
 - Airplanes in real time
 - NOAA Weather satellites
 - Digital TV (not in North America)
 - ...etc.





RTL SDR





rtl_433



- https://github.com/merbanan/rtl_433
- Available in Ubuntu repositories
- Decodes data from devices
- Can interface directly to MQTT
 - As well as other formats (Key/Value, CSV, JSON, InfluxDB, ...)
- Supports many devices
 - AcuRite, LaCrosse, Oregon Scientific, ...
 - Various Door and Window sensors
 - Some car models and TPMS (Toyota, Ford, ...)
- One dongle per frequency!





rtl_433 Config



- Either:
 - Command Line Arguments
 - Configuration File (the way I use it)





rtl_433 Config



```
device          1
gain            0
frequency       433.92M
output          mqtt://127.0.0.1:1883
convert         si
```

```
analyze_pulses          false
signal_grabber           none
stop_after_successful_events false
```

```
/usr/bin/rtl_433 -c /path/to/conf/rtl-acurite.conf
```





Rain is cumulative



Start date
November 3, 2024 at 12:00

End date
November 9, 2024 at 11:59

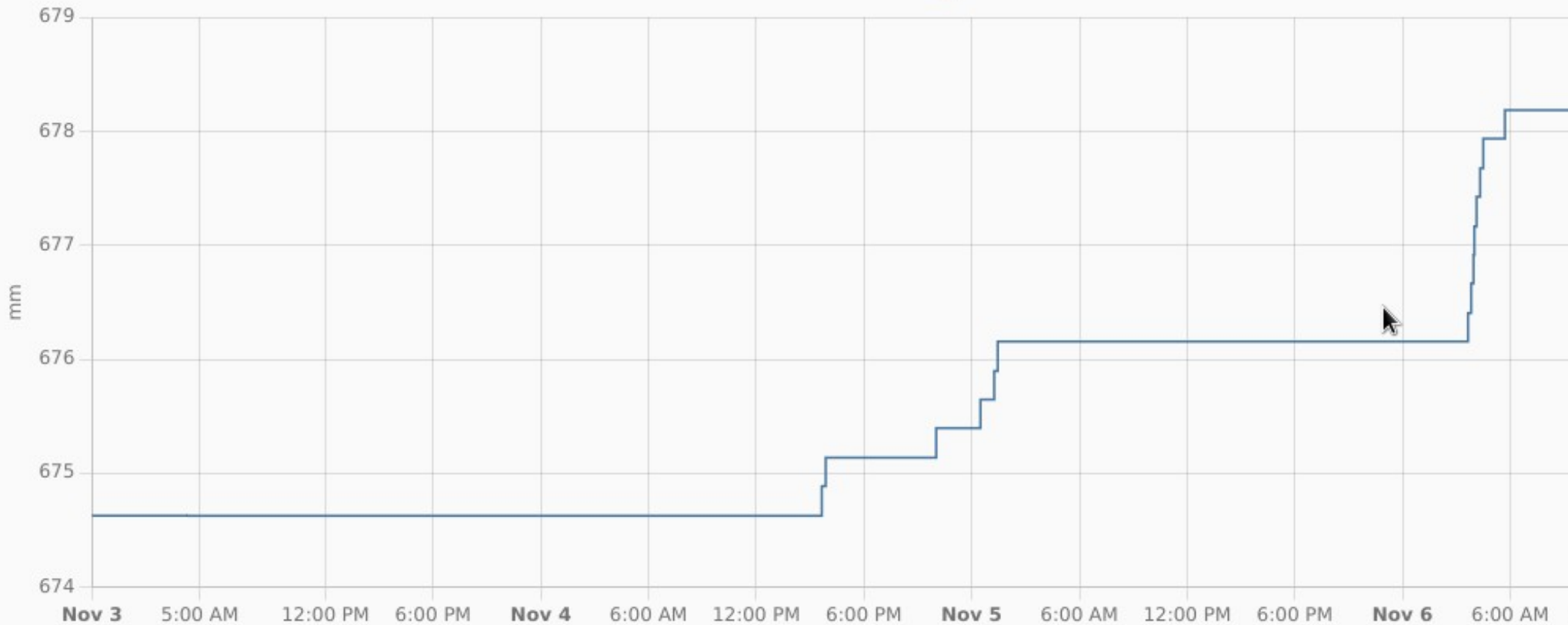
+ Choose area

+ Choose device

+ Choose entity

Local Rainfall x

Local Rainfall





Grafana solves it





Another Dashboard



Current Temperature -- C



Current Humidity -- %





Lightning Sensor



- Almost identical to the Tower sensor
 - Temperature, Humidity
 - Lightning Strike Count
 - Storm Front Distance
- Used for ~ \$10
- Requires certain displays, if not HA
- Beware of interference in basement
- Beeps when lightning detected
- Acts as temperature and humidity sensor for the basement
- Cumulative, Grafana transformation





Demo



- Home Assistant Weather
- Grafana Weather
 - Nov 10th regular rain, thunderstorm
 - June 20th for lightning, rainfall





WeeWX



- Comprehensive weather application
- Written in Python
- Has 'skins', (templates with features)
- Requires Hardware connection to (often expensive) weather stations
- Solution:
 - MQTTSubscribeDriver





- Temperature

value_template: >-

```
{%- set v = float(value) if is_number(value) -%}
```

```
{% if v <= 50 %}
```

```
{{ v }}
```

```
{% endif -%}
```





- Humidity

```
{%- set v = int(value) -%}
```

```
{% if v >= 0 and v <= 100 %}
```

```
{{ v }}
```

```
{% endif -%}
```





- Pressure

Adjust raw pressure value per METAR:

For Waterloo: Add 44

[https://en.allmetsat.com/metar-taf/southern-ontario.php?](https://en.allmetsat.com/metar-taf/southern-ontario.php?icao=CYKF)
icao=CYKF

value_template: >-

```
{%- set v = float(value) if is_number(value) -%}
```

```
{% if v >= 800 and v <= 1100 %}
```

```
  {{ v + 44 }}
```

```
{% endif -%}
```





Built-In Advanced



- Data range validation
- Averaging of observation interval (5 mins)
- Automatic conversion of raw pressure to sea level





Demo



- WeeWx
 - Yearly NOAA text reports
 - Highs and Lows
 - Comparison





Tap Into WeeWx DB



- You can do amazing things like:

```
sqlite3 /var/lib/weewx/weewx.sdb "  
SELECT  
    printf('%.1f', (outTemp - 32) / 1.8),  
    printf('%.1f', (appTemp - 32) / 1.8)  
FROM archive  
ORDER BY datetime DESC LIMIT 1;"
```

- Then use sed to format
- Use in a desktop panel





No Home Assistant?



- If you don't have Home Assistant, you can still get decent weather data
- AcuRite weather sensor/station
- SDR dongle
- Home Server or Raspberry Pi 4 or 5
 - rtl_433
 - Mosquitto MQTT
 - Weewx with MQTTSubscribeDriver





More To Come ...



More Home Assistant presentations?





Conclusion



Questions?

Comments?

