

technology

environment

security

# Internet of Things

Gives cost effective monitoring solutions

*Winterwind 2017*

**COMBITECH**



**Patrik Jonsson**

Ph.D.

[patrik.jonsson@combitech.se](mailto:patrik.jonsson@combitech.se)

# Internet of Things – according to Combitech

- Cost effective solutions
- Based on standardized hardware
- Reuse software developed in other projects
- Develop and use Opensource packages
- Quick development times, fast from idea to solution
- Combitech has many services that corresponds to IoT

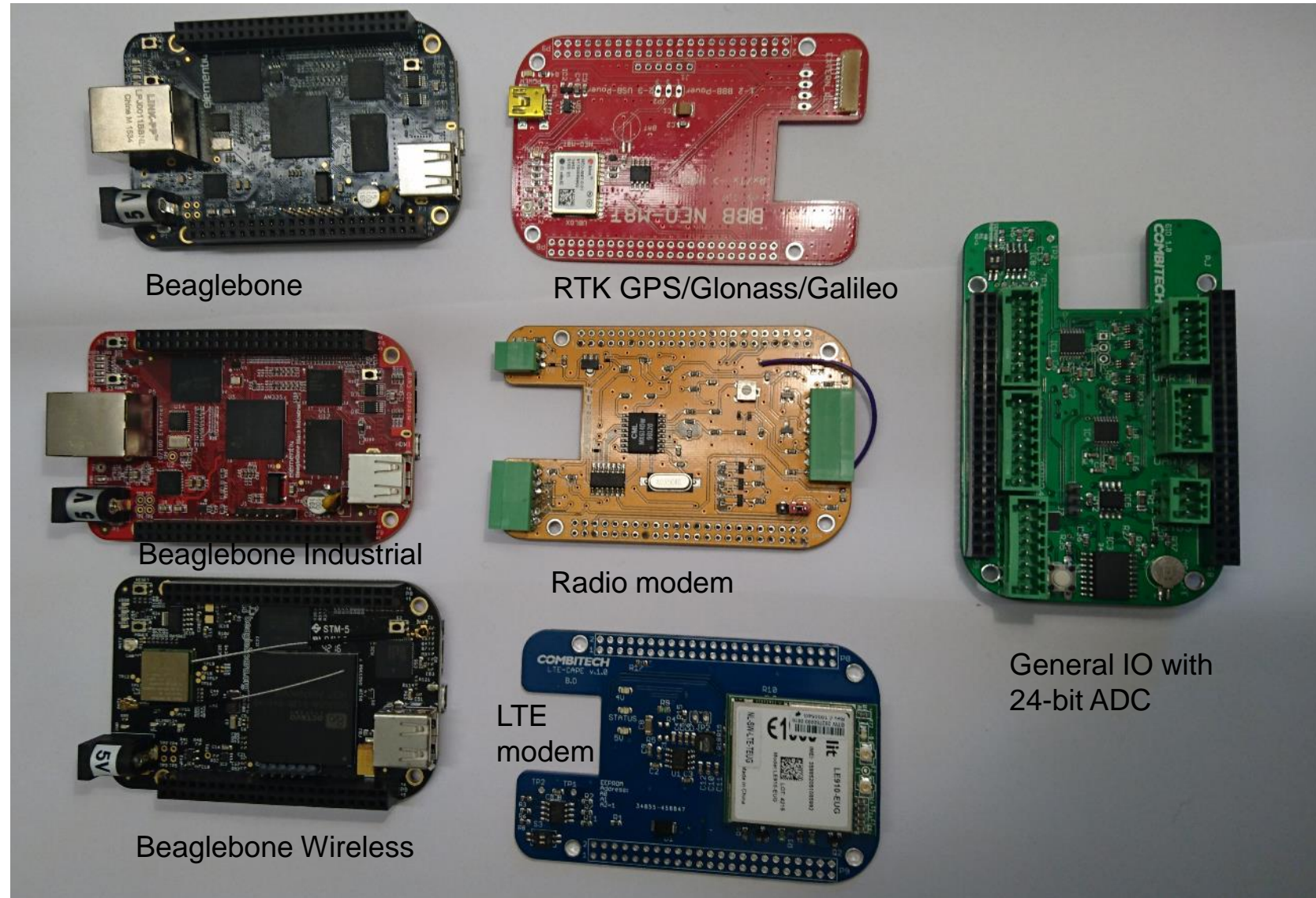
# Combitech IoT measurement platform

## Computer unit

- BeagleBone Black standard IoT platform
  - Industrial version with temp range -40C to +55C
  - Wifi version with integrated WiFi and bluetooth
- New hardware functions are implemented as *capex*
- Software is developed in C++ on Linux Debian
- Implements the Combitech advanced software integration platform

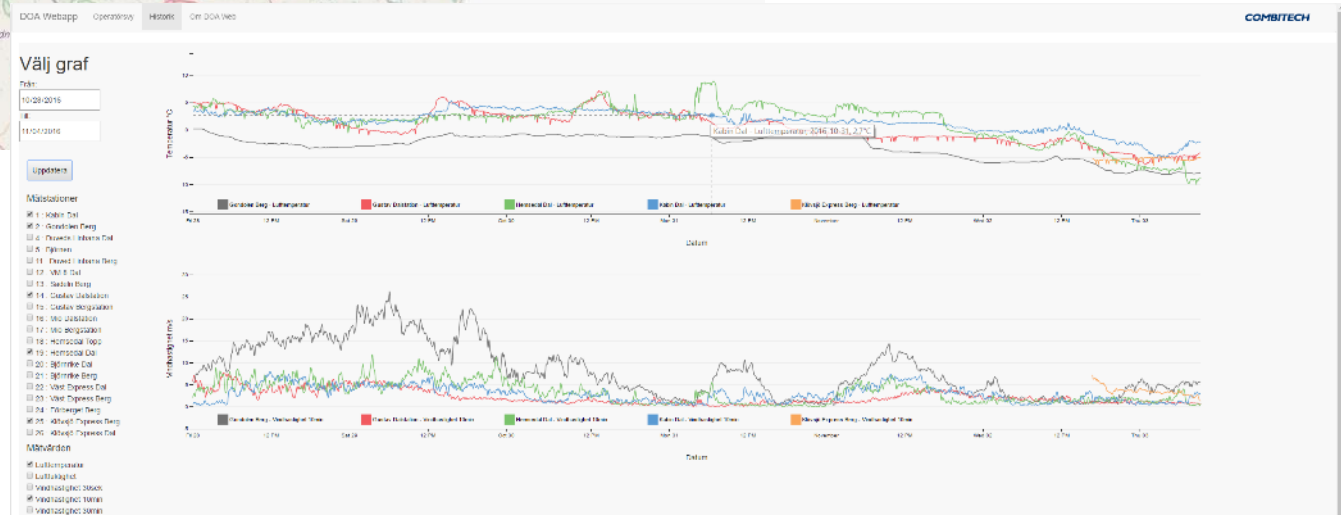
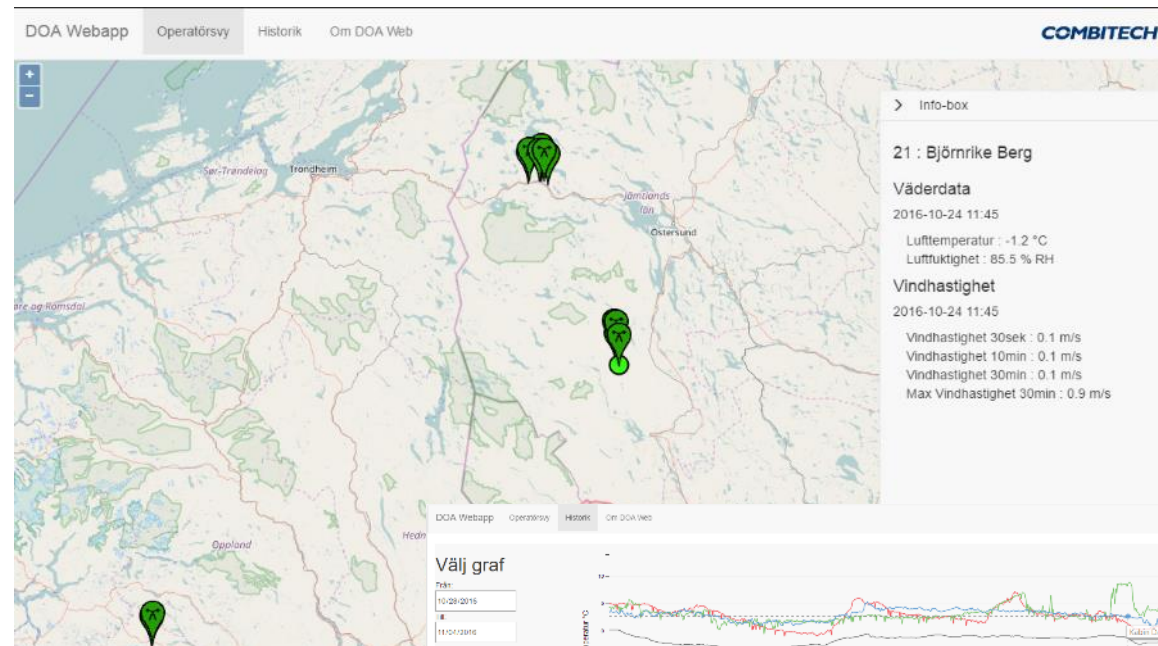
# Hardware

- BeagleBone standard MCU
- Capes developed by Combitech for specific needs
  - RTK GNSS (GPS, Glonass, Galileo)
  - Radio modem
  - LTE modem (3G/4G)
  - General IO



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# IoT applications – weather monitoring

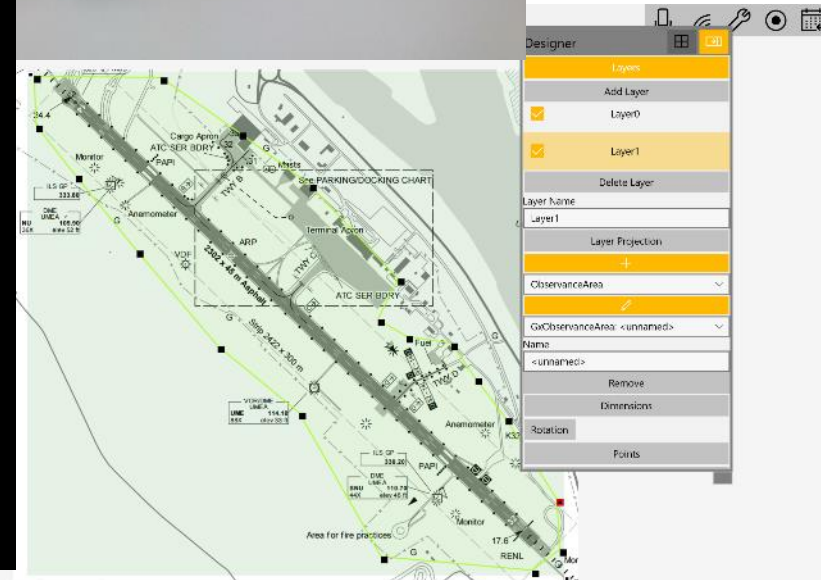
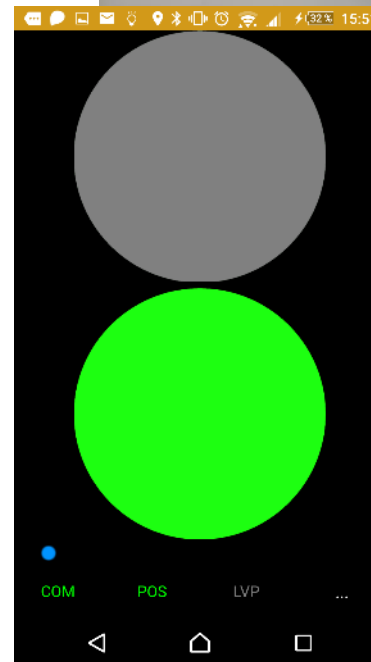
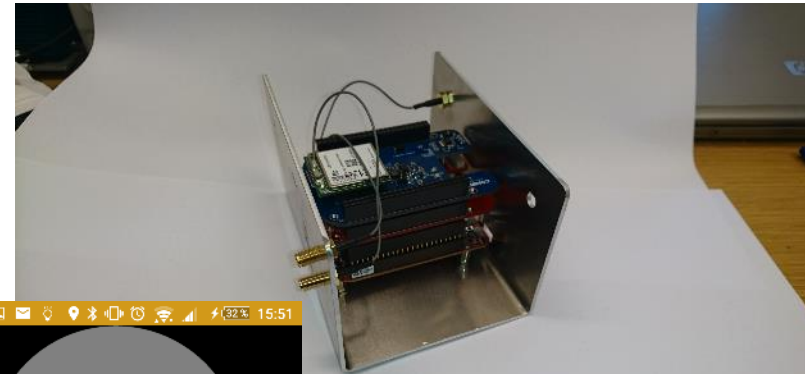


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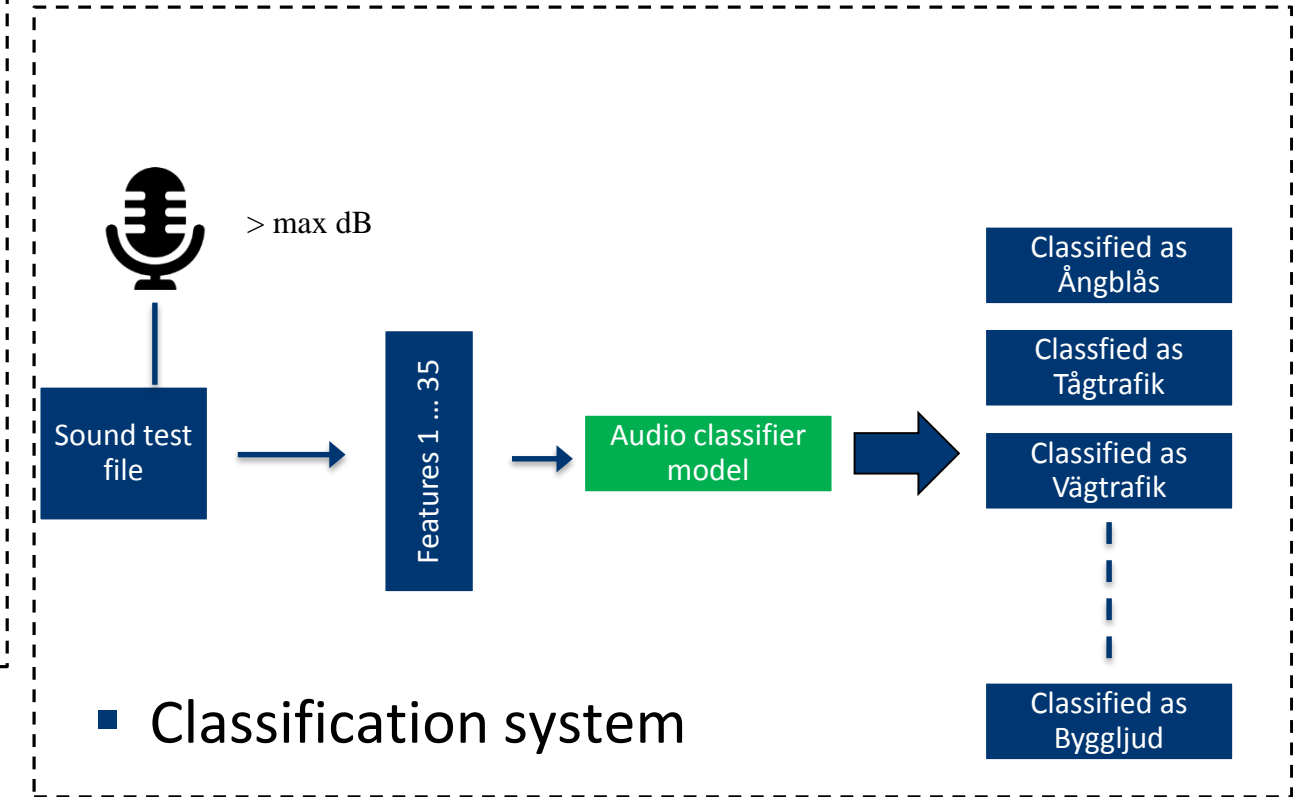
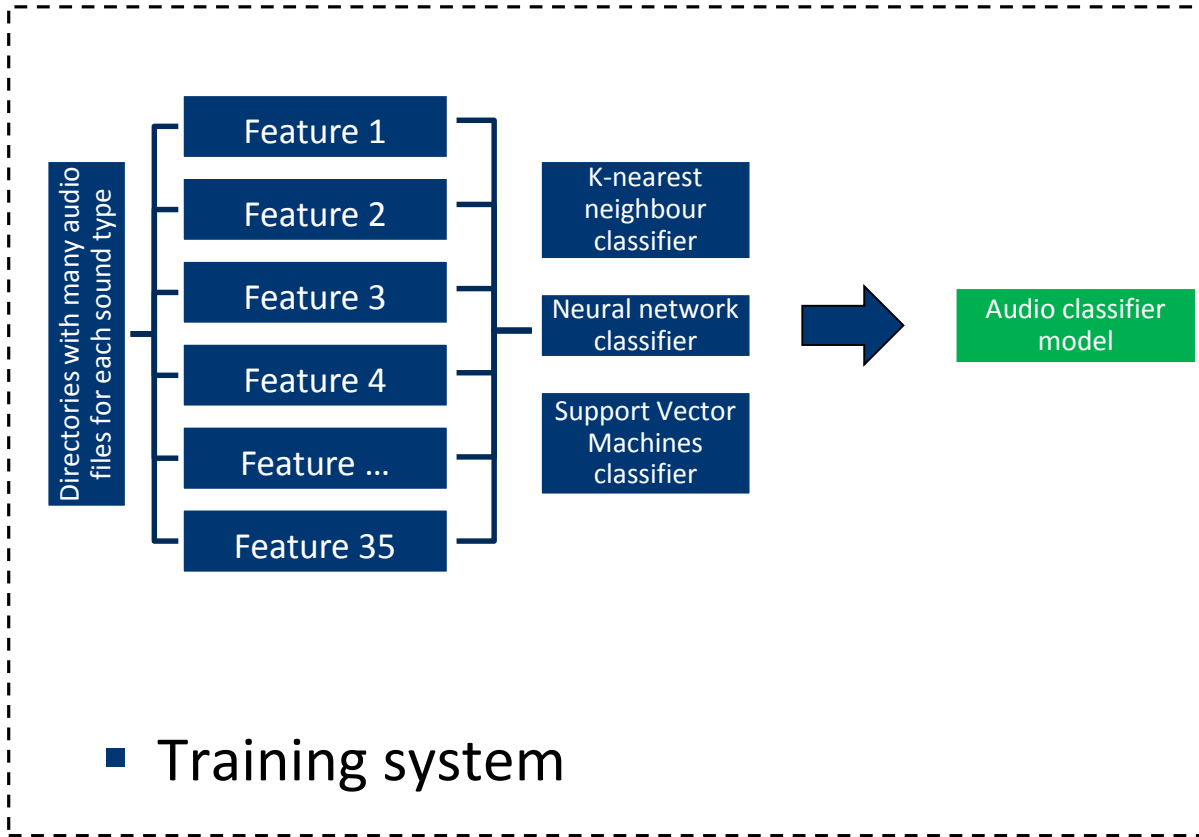
# IoT applications – vehicle tracking

- Tracking and geofencing
- Vehicle computer unit with RTK GNSS positioning <1cm accuracy
- Vehicle smartphone with position information and communication interface
- Authorization to geofenced areas

**Cost effective RTK positioning**

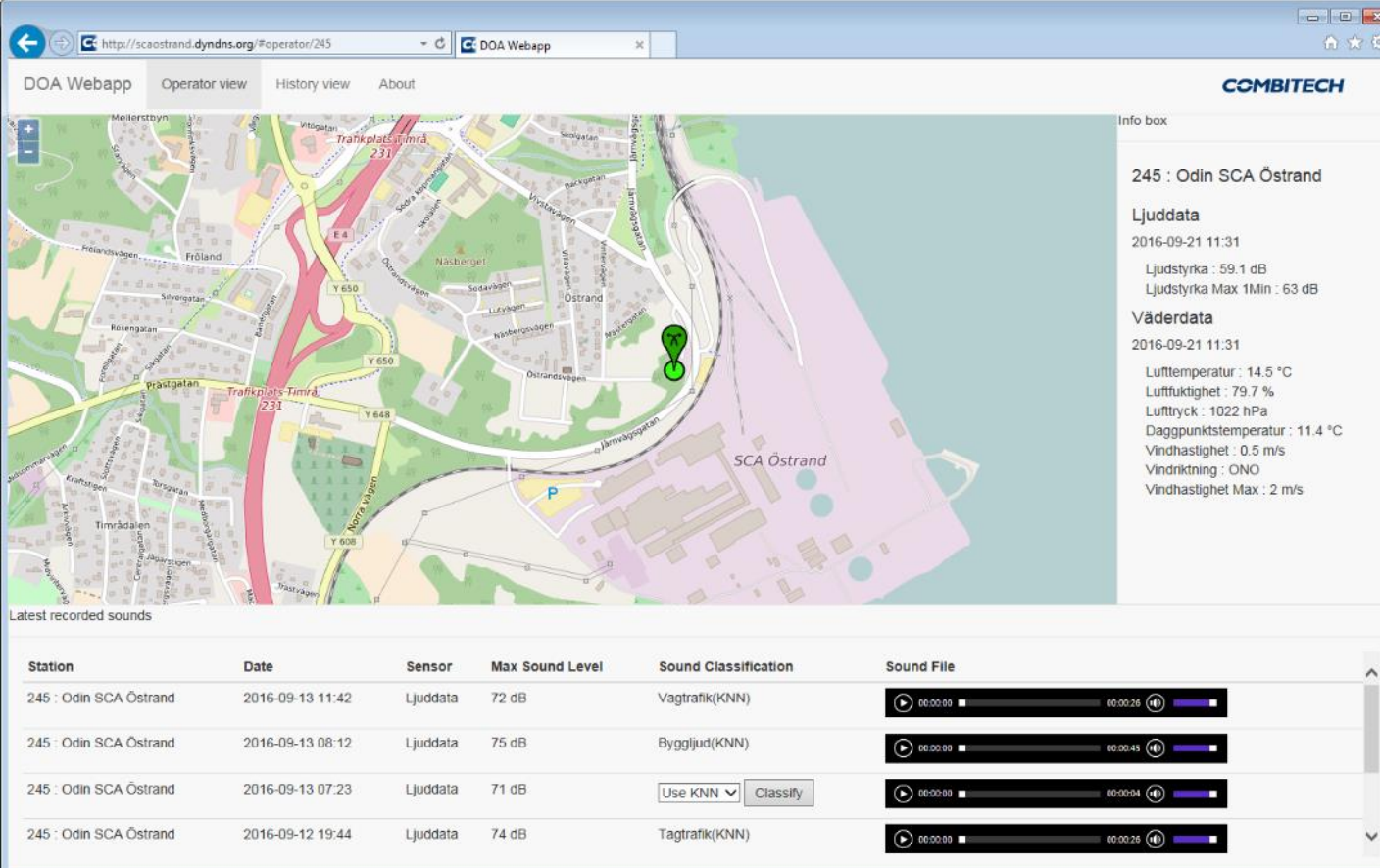


# IoT applications – sound analysis



# IoT applications – sound analysis

- Web based user interface
- Recorded audio files are retrieved and can be replayed for user
- Classification system can be run on each audio file
- Any sound profile can be trained to detect, for example **wind turbine noise**







The screenshot displays the DOA Webapp interface. At the top, there is a navigation bar with 'Operator view', 'History view', and 'About' options. The main area features a map of Östrand, Sweden, with a green pin indicating the location of the SCA Östrand station. To the right of the map is an 'Info box' containing the following data:

245 : Odin SCA Östrand

**Ljuddata**  
2016-09-21 11:31  
Ljudstyrka : 59.1 dB  
Ljudstyrka Max 1Min : 63 dB

**Väderdata**  
2016-09-21 11:31  
Lufttemperatur : 14.5 °C  
Luftfuktighet : 79.7 %  
Lufttryck : 1022 hPa  
Dagpunktstemperatur : 11.4 °C  
Vindhastighet : 0.5 m/s  
Vindriktning : ONO  
Vindhastighet Max : 2 m/s

Below the map is a table titled 'Latest recorded sounds' with the following columns: Station, Date, Sensor, Max Sound Level, Sound Classification, and Sound File.

Station	Date	Sensor	Max Sound Level	Sound Classification	Sound File
245 : Odin SCA Östrand	2016-09-13 11:42	Ljuddata	72 dB	Vagtrafik(KNN)	
245 : Odin SCA Östrand	2016-09-13 08:12	Ljuddata	75 dB	Byggjud(KNN)	
245 : Odin SCA Östrand	2016-09-13 07:23	Ljuddata	71 dB	<input type="button" value="Use KNN"/> <input type="button" value="Classify"/>	
245 : Odin SCA Östrand	2016-09-12 19:44	Ljuddata	74 dB	Tagtrafik(KNN)	



# IoT - LWC and MVD measurement system

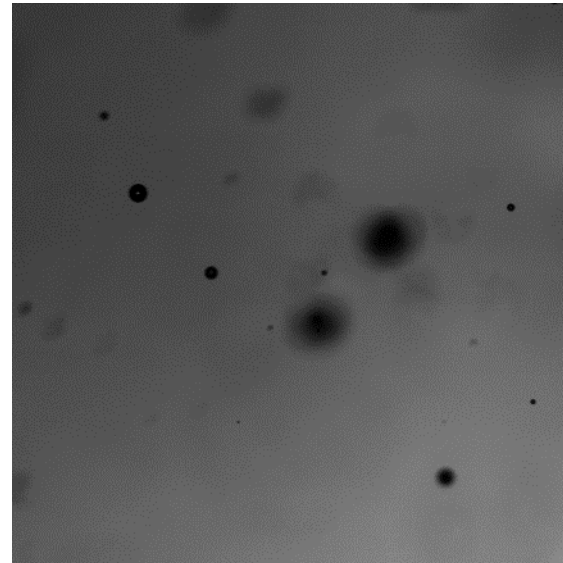
- Icing is related to the amount of atmospheric liquid water and the size of the droplets.
- The Droplet Imaging Instrument was developed by Mid Sweden University in co operation with Combitech and SMHI.
- Tests with this instrument shows that it is possible to make high precision measurements of LWC and MVD using a simple and robust hardware.



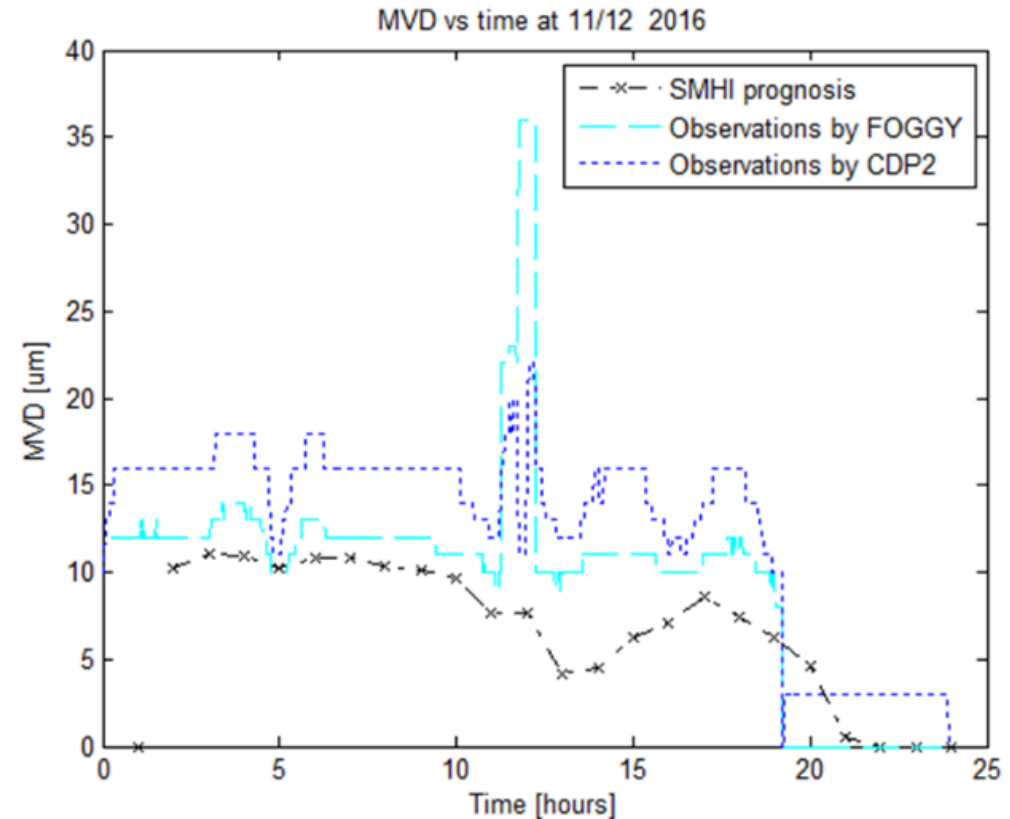
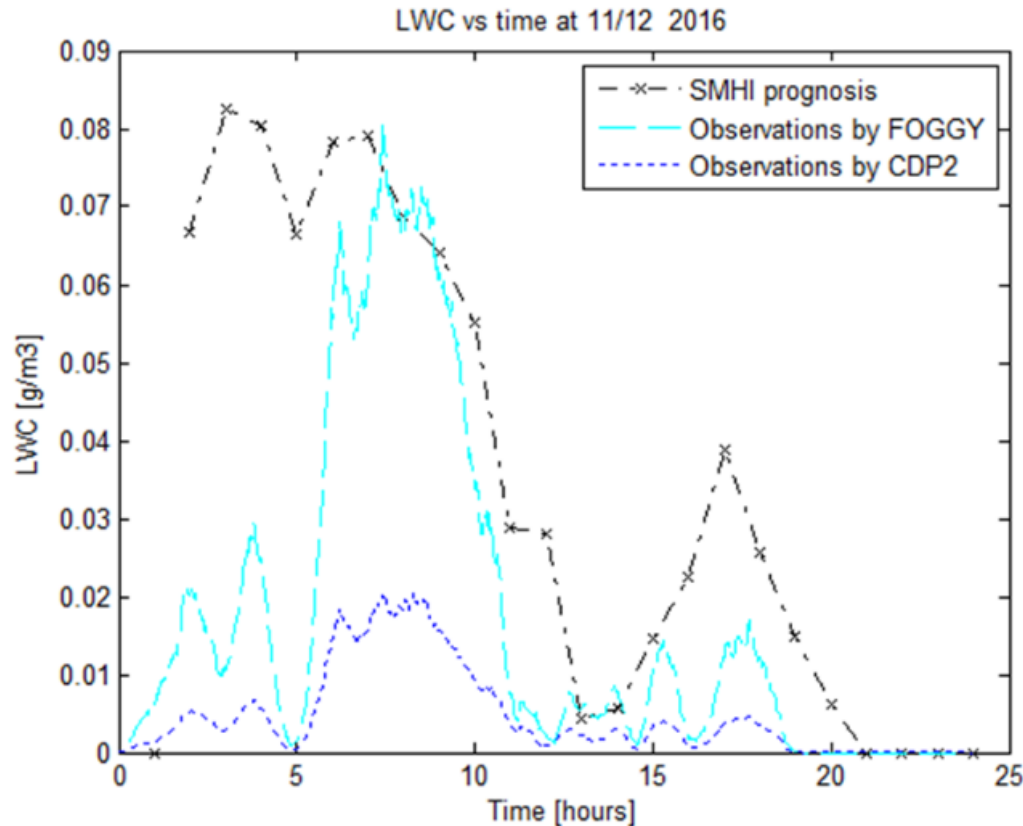
**Droplet Sizing for Ice Detection**

# Droplet Sizing for Ice Detection

- Tests with the prototype was done at SMHI weather station at Klövsjö, Sweden during the winter 2016-2017.
- Through image processing both LWC and MVD can be derived with high accuracy and precision.
- An IoT instrument based on the design can be deployed at weather stations, wind farms, mobile masts etc.
- Data from this instrument can be used to confirm and improve current weather models.



# Droplet Sizing for Ice Detection



Successful results - consistent measurements, reference sensor CDP-2 and SMHI predictions

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# For further information - contact



- Patrik Jonsson



- Björn Ollars

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