INF230 Project Davis

Weather stations

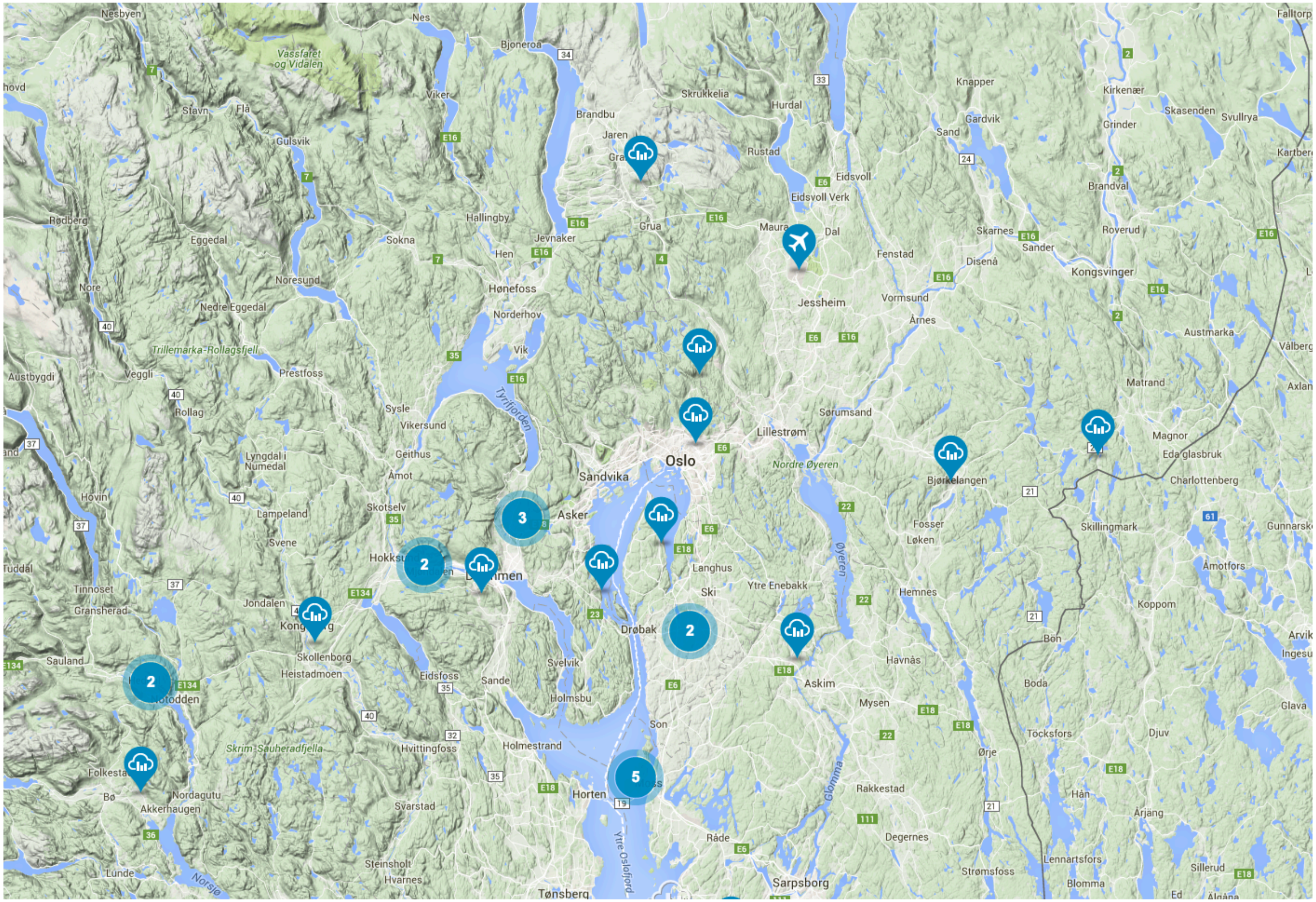
Project Weather stations

- During the next weeks we will work with weather stations
- Collecting data
- Data base
- Analysis
- Working in groups
- We will work with everything we have learned of SQL and data bases

Davis weather stations

- Short about Davis weather stations
- Many weather stations are coupled together through Davis Weatherlink
  - http://www.weatherlink.com
- WeatherLinkIP™
  - A data logger that allows automatic loading of weather data from a local weather station from Davis Instruments webserver
- NMBU has 2(3) weather stations
  - Pentagon 8. etg
  - Sørås
  - (Notodden (private))

Weather stations



Web services for weather

- Davis Weatherlink
  - http://weatherlink.com
- WeatherCloud
  - http://app.weathercloud.net
- Weather Underground
  - http://wunderground.com
- Citizen Weather Observer Program
  - http://www.wxqa.com
- Met Office (WOW)
  - http://wow.metoffice.gov.uk/

Citizen Weather Observer program (CWOP) http://wxqa.com/

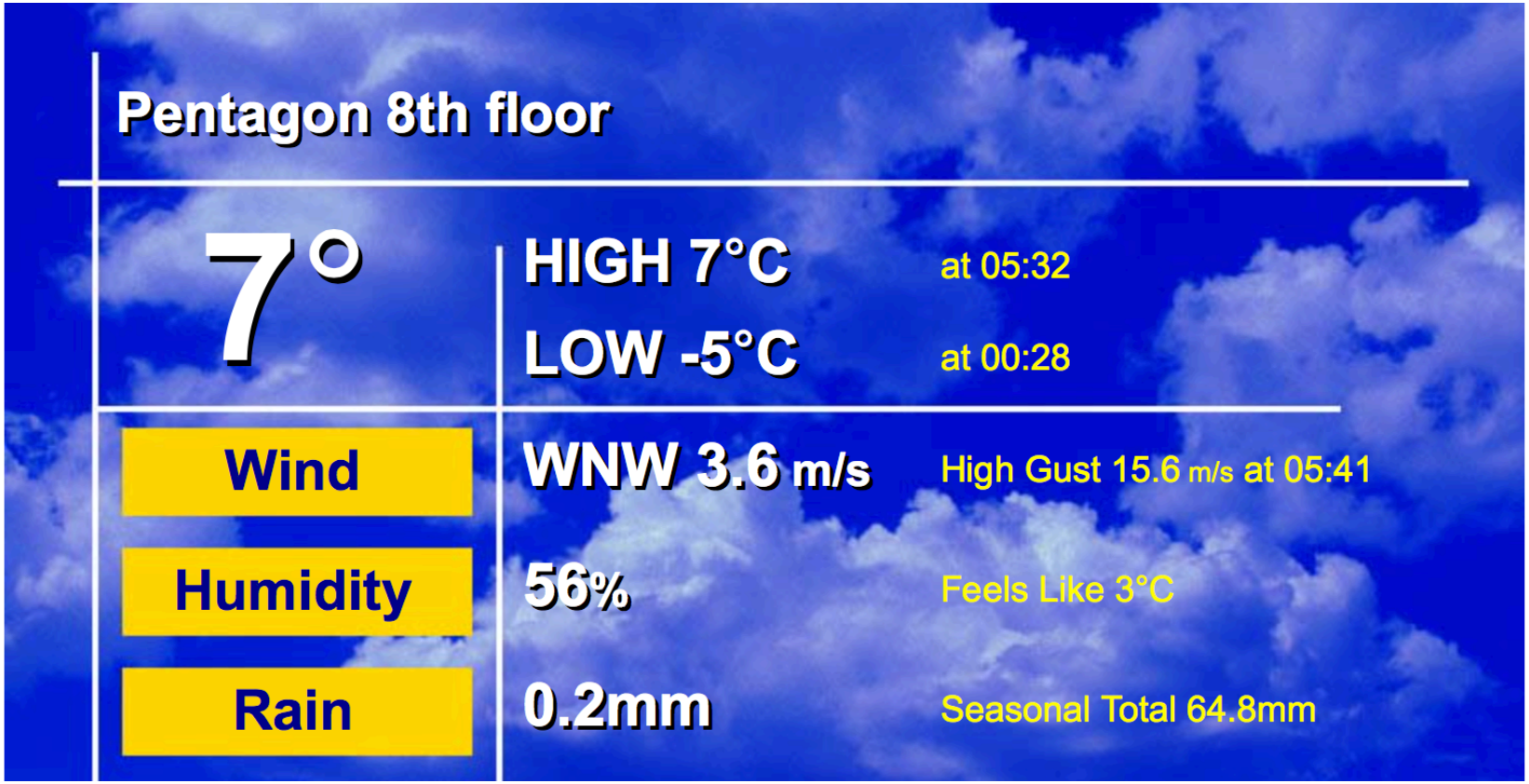
- Search for a weather station
  - http://www.wxqa.com/search.htm
  - Heddal, Notodden: **EW7230**
  - http://www.wxqa.com/sss/search1.cgi?keyword=EW7286
  - http://weather.gladstonefamily.net/site/search?site=E7286&Get+information=Get+information
  - http://weather.gladstonefamily.net/site/search?site=E7230&Get+information=Get+information

Davis Advantage Pro2

Web page for Davis Pentagon

- URL:
- Overview
  - http://www.weatherlink.com/user/woodbebetter
- Details
  - http://www.weatherlink.com/user/woodbebetter/index.php?view=summary&headers=1&type=1
- Updated every minute
  - Headers=0, 1 (default units=0, metric=1)
  - Type=1 - Metric

Pentagon Overview



Pentagon Details

WeatherLink® Network

Pentagon 8th floor

Current Conditions as of 11:13 Saturday, February 7, 2015

Station Summary	Current	Today's Highs		Today's Lows	
Outside Temp	6.8 C	6.9 C	05:32	-5.3 C	00:28
Outside Humidity	56%	96%	00:00	56%	05:38
Inside Temp	28.4 C	28.6 C	00:00	28.4 C	03:21
Inside Humidity	13%	13%	00:00	13%	00:00
Heat Index	6.1 C	6.1 C	05:26		
Wind Chill	3.3 C			-6.7 C	00:28
Dew Point	-1.7 C	0.0 C	04:34	-6.1 C	00:20
Barometer	1007.9hPa	1014.3hPa	00:00	1007.9hPa	05:45
Bar Trend	Falling Slowly				
Wind Speed	5.4 m/s	15.6 m/s	05:41		
Wind Direction	WNW 298°				
Solar Radiation	93 W/m^2	153 W/m^2	05:28		
UV Radiation	0.0 Index	0.0 Index	n/a		
12 Hour Forecast	Increasing clouds and cooler. Precipitation possible within 6 hours. Windy with possible wind shift to the W, NW, or N.				

Wind	2 Minute	10 Minute
Average Wind Speed	6.1 m/s	6.7 m/s
Wind Gust Speed		15.6 m/s

Rain	Rate	Day	Storm	Month	Year
Rain	0.0mm/Hour	0.2mm	0.0mm	0.4mm	64.8mm
Last Hour Rain	0.2mm				
ET		0.03mm		1.8mm	9.1mm

Extra Sensors	Current	Today's Highs		Today's Lows	
Leaf Wetness 1	0	0	00:00	0	00:00
Leaf Wetness 2	0	15.0	04:31	0	00:00

Davis Vantage Pro 2

The Davis Vantage Pro2 Plus Weather Station

The Davis Vantage Pro2 Plus weather stations are typically mounted on the south side of school roofs so that the solar powered unit (shown here) receives unobstructed sunlight. The weather stations transmit data to a monitor located in the school and a small 3 Volt Lithium CR123A battery provides a backup power source for the unit.

The weather station measures temperature, humidity, rain amount & rate, solar radiation, UV index, wind speed and wind direction. See our information page for a brief description of these weather variables and for a table showing the sensor specifications & accuracy.


Panasonic
ISS Transmitter
6162
Davis Instruments

The Monitor

A small portable display monitor is located in each school, typically in the school library, main office or computer lab. The display unit is hooked up to the computer we provide and this is connected to the school network. Data is then sent once a minute to our central server located at the University of Victoria and this data is made available through our website.

Most of the display monitors have been set to display wind speed (in kilometers per hour), temperature and wind chill (in degrees Celcius), UV index, Daily rain (in mm), solar radiation (in Watts per square metre) and air pressure (in millibars) like the unit shown here. These settings can be changed by referring to either the complete manual or to the quick reference guide.

Air pressure is measured within the display monitor and is corrected to sea level. This means that we need to accuracy know the elevation of where we install the display monitor.

Measuring Wind

The wind speed is measured by a simple Cup Anemometer. The wind speed is determined by measuring how many times the cups (seen in the photo) turn full circle in a second.

A Weather Vane is also attached to the unit. It points towards (and then reports) the direction from which the wind is blowing.

At each school, the arm holding the anemometer and weather vane always points northward (and the solar panel is always facing the south). The picture to the right shows wind coming from the south (southerly wind).

Measuring Rain

The amount of rain is measured using a Tipping Bucket rain gauge (shown here).

Rain falls into the black cylinder (seen from above in the top photo on the right) which acts as a funnel and channels the water through a small hole in the base of the cylinder. The water then falls into one of two collectors which are balanced on a pivot (seen in the bottom photo on the right). Every time 0.254 mm (0.01 inch) of rain falls, the collector fill up and tips, thereby sending an electric signal to the receiving unit. By measuring the time between tips, the rain rate can be measured.

The black cylinder is not heated so that when it snows, the snow will accumulate until such time as conditions allow it to melt. Melting snow will then fill the collecters with water causing them to tip. As a consequence, a snow fall will be recorded as a rain event once the snow has melted.

Measuring Solar Radiation & the UV Index

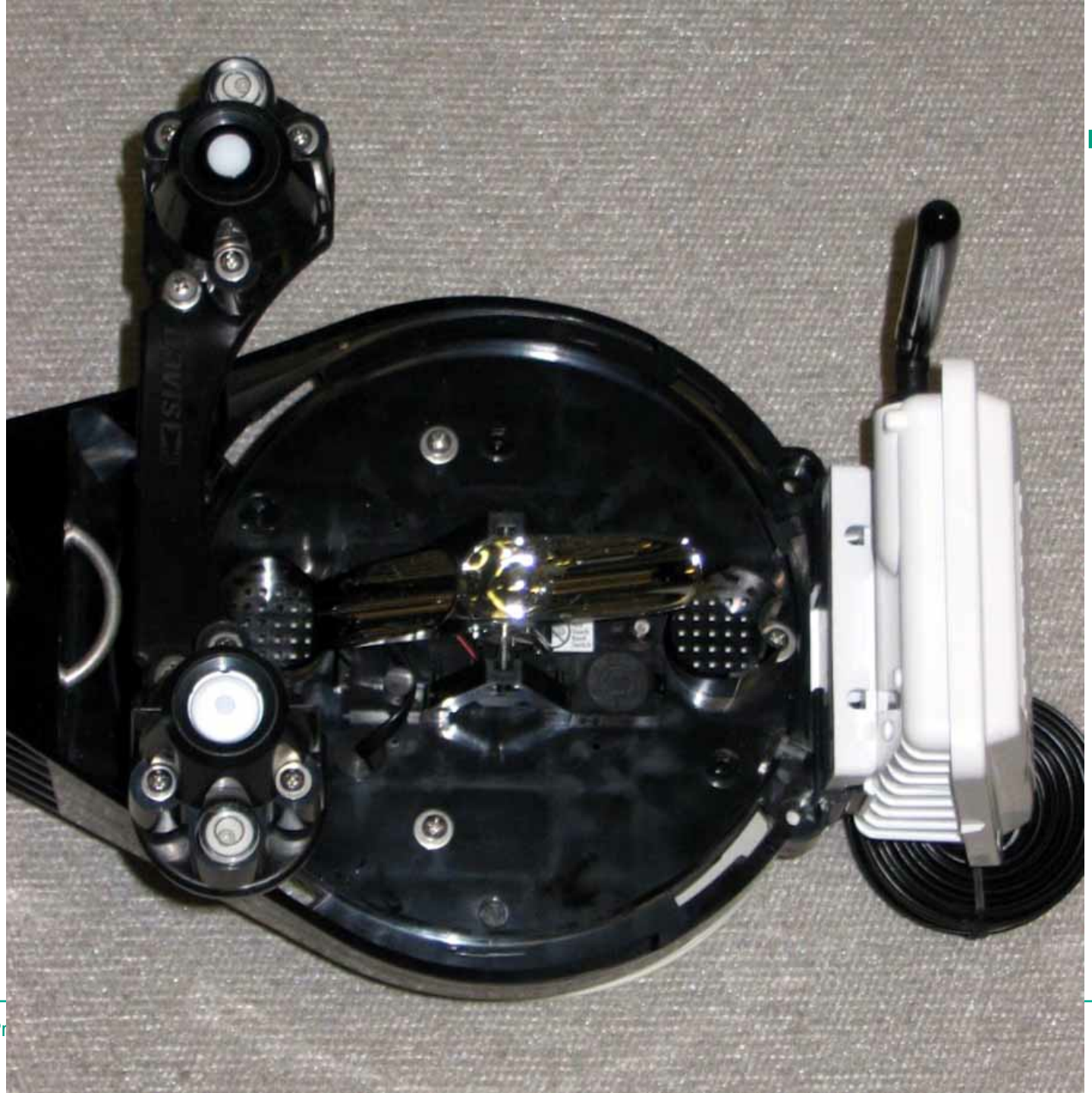
The weather station has a Solar Radiation Sensor (a silicon photodiode detector) that measures the solar radiation with wavelengths between 300 and 1100 nanometers. It is the small white disk located in the top left of the picture below.

The weather station also has a Ultraviolet Radiation (UV) Sensor that measures the UV radiation with wavelengths between 290 and 390 nanometers. It is the small white disk located in the bottom left of the picture below.

An interpretation of the UV index is given in the table on the right.

UV Index	Description	Recomended Protection
0-2	Low danger to the average person	Wear sunglasses; wear sunscreen if there is snow on the ground, which reflects UV radiation, or if you have particularly fair skin.
3-5	Moderate risk of harm from unprotected sun exposure	Wear sunglasses and sunscreen, cover the body with clothing and a hat, and seek shade around midday when the sun is most intense.
6-7	High risk of harm from unprotected sun exposure	Wear sunglasses and sunscreen having SPF 15 or higher, cover the body with clothing and a wide-brim hat, and reduce time in the sun from two hours before to three hours after solar noon.
8-10	Very high risk of harm from unprotected sun exposure	Same precautions as above, but take extra care - unprotected skin can burn quickly.
11+	Extreme risk of harm from unprotected sun exposure	Take all precautions, including: wear sunglasses and sunscreen, cover the body with a long-sleeve shirt and pants, wear a broad hat, and avoid the sun from two hours before to three hours after solar noon.

Source: http://epa.gov/sunwise/uviscale.html.

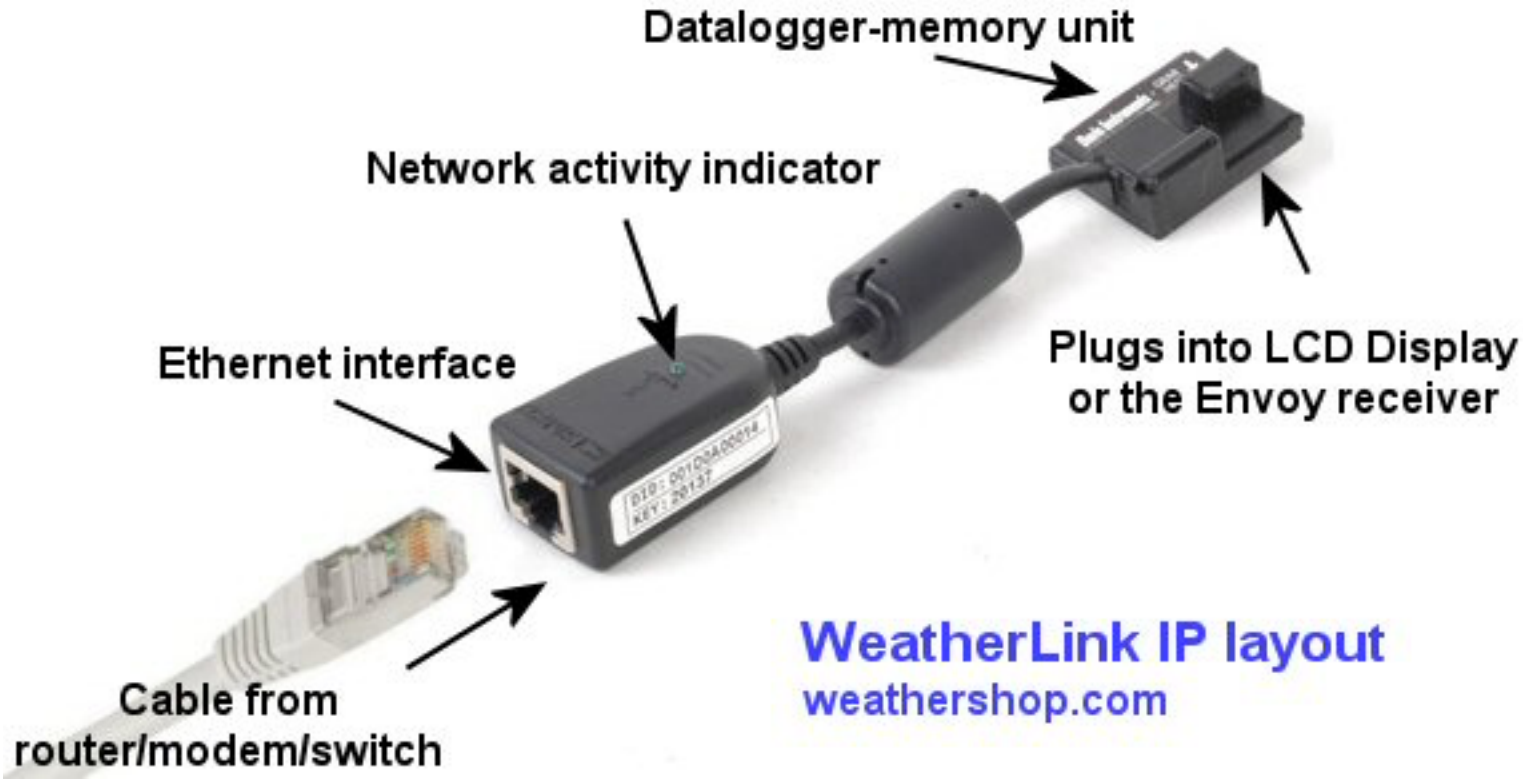


Measuring Temperature and Humidity

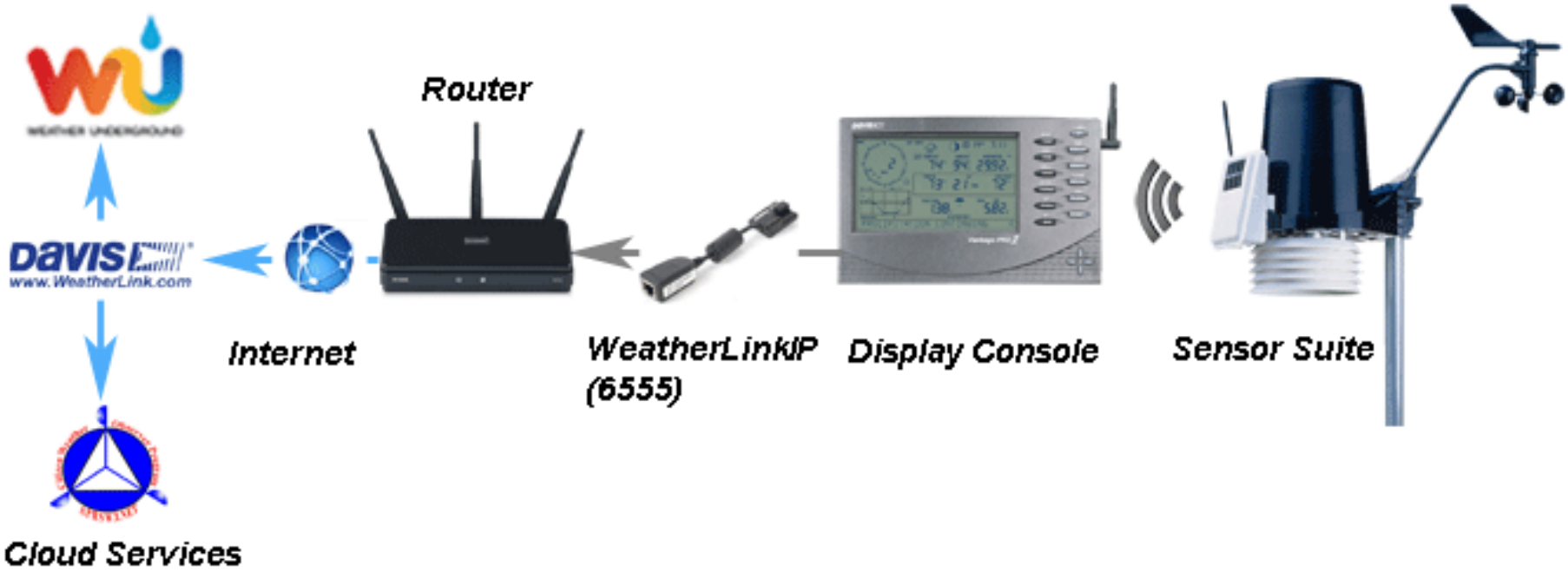
The temperature and humidity sensor is found within the white radiation shield attached to the bottom of the weather station (shown to the right). This radiation shield protects the sensor from direct sunlight in the day and reduces radiative heat loss at night. It allows the temperature and humidity sensor to better measure the actual air temperature.

In the three photos below, the radiation shield has been dismantled to show where the temperature and humidity sensor is located.

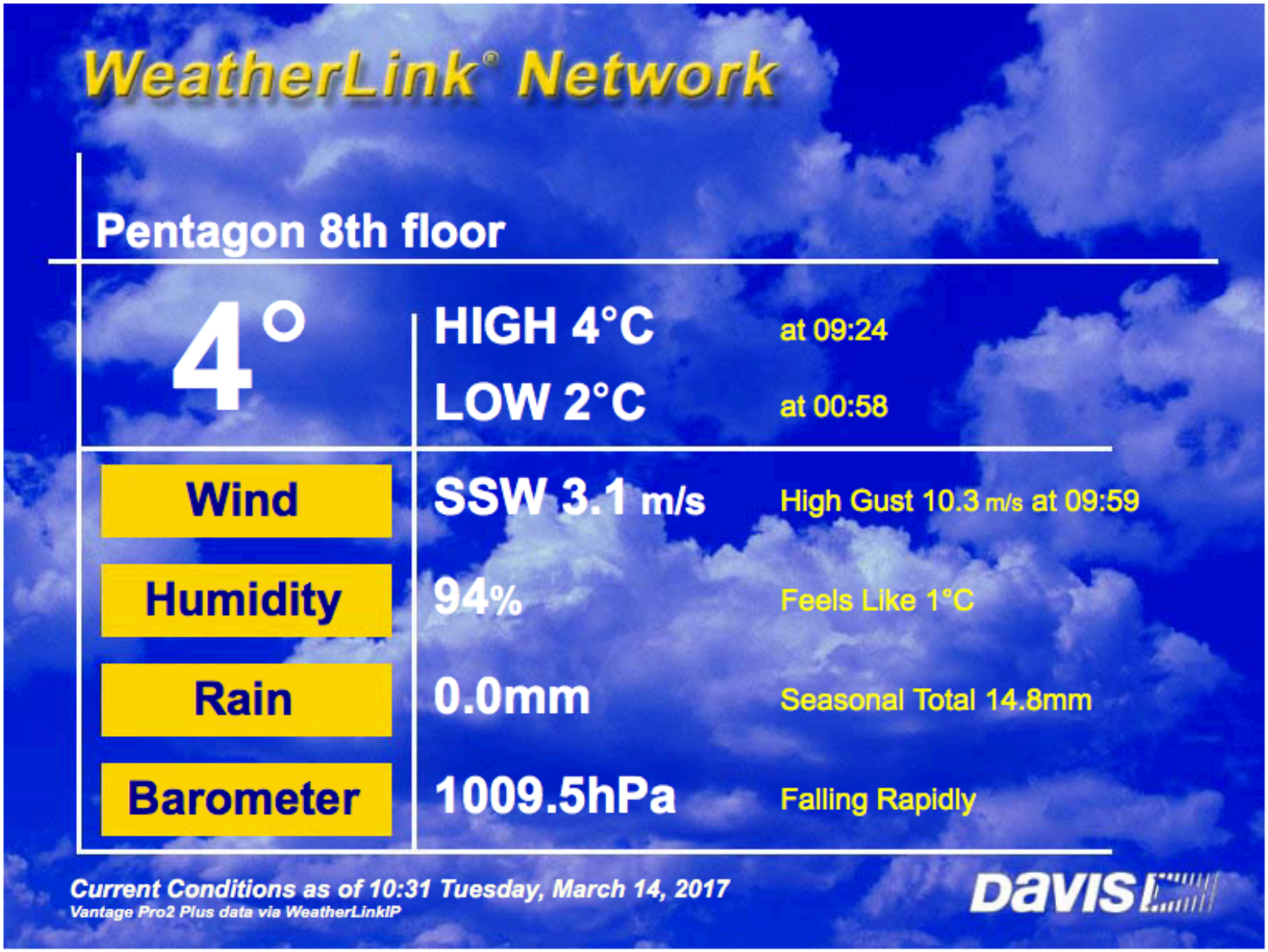
Weatherlink IP



Logging data from a weather station



http://www.ambientweather.com/in.html



View page units as: Station Defaults

WeatherLink®

DAVIS

FAQ's | Order Now | Register

My Weather | Summary | No Headers | Map | Login

WeatherLink® Network

Pentagon 8th floor

Current Conditions as of 10:32 Tuesday, March 14, 2017

Station Summary	Current	Today's Highs		Today's Lows	
Outside Temp	3.7 C	4.2 C	09:24	1.9 C	00:58
Outside Humidity	94%	97%	02:24	90%	09:23
Inside Temp	28.8 C	29.3 C	06:19	28.8 C	09:30
Inside Humidity	17%	17%	00:00	17%	00:00
Heat Index	3.9 C	4.4 C	09:20		
Wind Chill	3.9 C			-1.1 C	07:58
Dew Point	2.8 C	2.8 C	08:54	1.7 C	00:00
Barometer	1009.6mb	1016.7mb	00:04	1009.3mb	10:33
Bar Trend	Falling Rapidly				
Wind Speed	Calm	37 km/h	09:59		
Wind Direction	S 190°				
Solar Radiation	44 W/m²	54 W/m²	09:10		
UV Radiation	0.0 Index	0.0 Index	n/a		
12 Hour Forecast	Mostly cloudy and cooler. Precipitation likely. Windy with possible wind shift to the W, NW, or N.				

Wind	2 Minute	10 Minute
Average Wind Speed	5.0 km/h	9.7 km/h
Wind Gust Speed		19.3 km/h

Rain	Rate	Day	Storm	Month	Year
Rain	0.0mm/Hour	0.0mm	0.0mm	0.0mm	14.8mm
Last Hour Rain	0.0mm				
ET		0.05mm		8.9mm	23.6mm

Extra Sensors	Current	Today's Highs		Today's Lows	
Leaf Wetness 1	15.0	15.0	02:52	0	06:48
Leaf Wetness 2	2.0	12.0	09:56	0	07:10

View page units as: Metric

METRIC!!

Log data from weather station

- Data can be downloaded directly from the Davis console through a pc

- Data can be downloaded from weatherlink.com
  - Davis.com fetches data every minute
  - Only the data shown on the web page are available

- The weather station can be linked to Weather Underground
  - Wunderground.com
  - Data can be downloaded from there
- INF230 pyGrabDavis
  - Log data to a local file
  - Log data directly to a MySQL data base

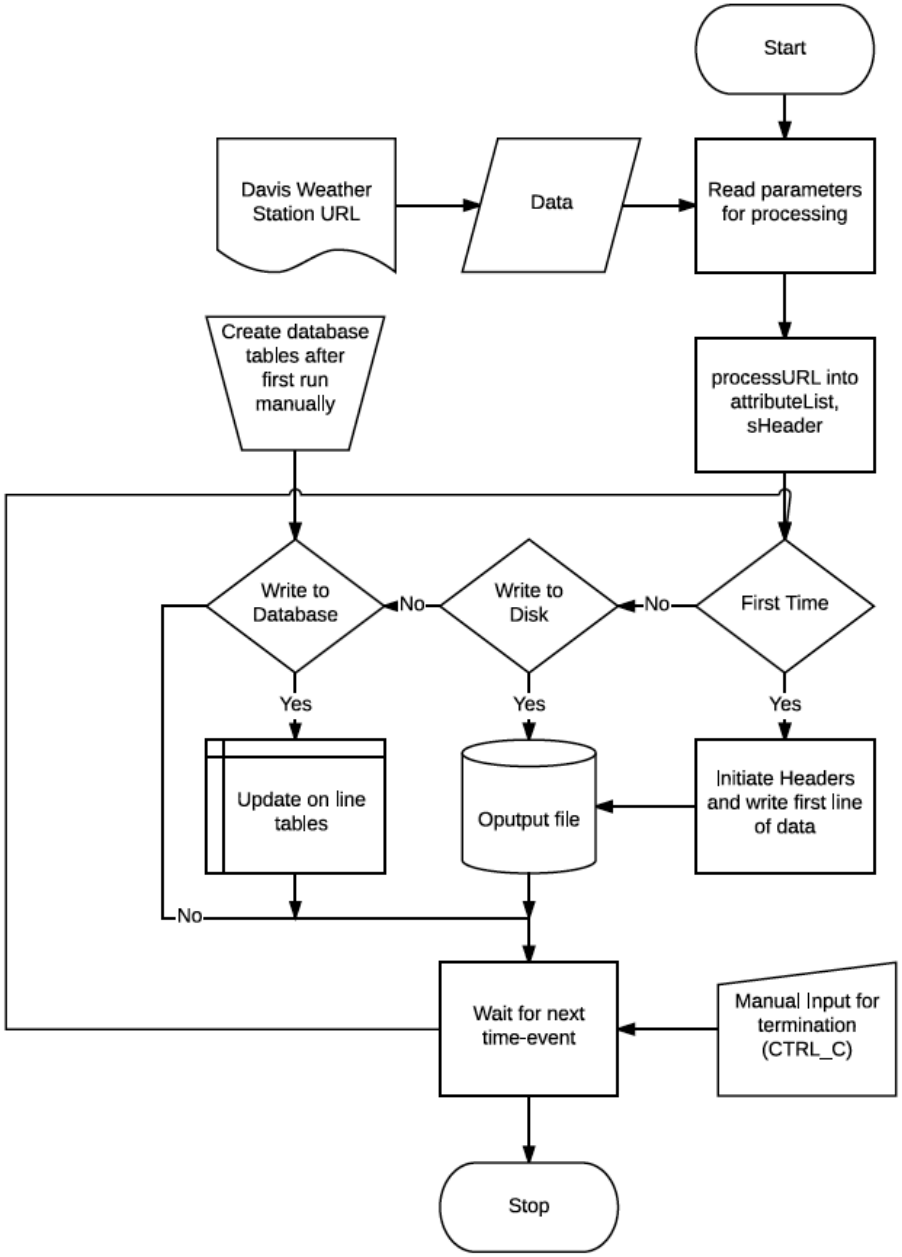
INF230 Davis Project

- Data will be downloaded from a given weather station
- A program written in Python 3 for logging will be provided
  - you are free to improve the program !!

  - The module pymysql must be installed
    - conda install pymysql

Basis for the project is the first exercise

- We will collect data from weather stations around the globe
- Each Davis station linked to internet can be found here innes http://weaterlink.com.
- We will use a technique called web-scraping.
- Each group will use 2 weather stations
- All continents are of interest
- Solar radiance and UV-index must be logged


Start
Davis Weather Station URL
Data
Read parameters for processing
Create database tables after first run manually
processURL into attributeList, sHeader
Write to Database
No
Write to Disk
No
First Time
Yes
Yes
Yes
Update on line tables
Oputput file
Initiate Headers and write first line of data
No
Wait for next time-event
Manual Input for termination (CTRL_C)
Stop

PyGrabDavis(2/3)

PyGrabDavisX -u <urlfile> -o <outputfile> -c <sep> -d -i <inverval>
-u URL –r <user> -p <password> -t <table> -b <database>

-o outputfile (csv)

-c separator in csv file (, and .)

-d database insert (db=davis, table=tdavis)

-i interval sleep for refresh of URL

-r user name for database login

-p password for database login

-b data base database login

-t table for database login

Information from web page

```
# Read the actual URL and let BeautifulSoup handle the rest
    try:
    html = urllib.request.urlopen(url).read()
except:

    print("No connection. Waiting 2 min to try again or stop..")
    time.sleep(float(120.0))
    html = urllib.request.urlopen(url).read()

soup = BeautifulSoup(html,"lxml")

# kill all script and style elements
for script in soup(["script", "style"]):
    script.extract()    # rip it out
# end for

# get text
text = soup.get_text()

# break into lines and remove leading and trailing space on each
lines = (line.strip() for line in text.splitlines())
```

Information from web page

```
# break multi-headlines into a line each
chunks = (phrase.strip() for line in lines for phrase in line.split("  "))
# drop blank lines
text = '\n'.join(chunk for chunk in chunks if chunk)

# Split the text into separate lines
textlines=text.split('\n')

# Find id line (index 2)

translation_table = dict.fromkeys(list(map(ord, ',')), None)
sCurrentCond = textlines[2].translate(translation_table)
vDateKey = str(sCurrentCond.split("of ")[1:][0])
header=[]
attributeList=[]
header.append('idtime;')
attributeList.append(vDateKey)
# Weather station ID
header.append('wsid;')
attributeList.append(wsid)
```

Pick attributes from the text

```
if 'Outside Temp'  in textlines:
    header.append('otemp;')
    outTemp=textlines.index('Outside Temp')
    translation_table = dict.fromkeys(map(ord, 'C %'), None)
    textlines[outTemp+1] = textlines[outTemp+1].translate(translation_table)
    vOutTemp=str(textlines[outTemp+1])
    attributeList.append(vOutTemp)
 # end if
```

Date and time

```
timeStamp=attributeList[0]
f = '%Y-%m-%d %H:%M:%S'
TimeStampD= parse(timeStamp).strftime(f)

attributeList[0]=TimeStampD

return(attributeList,sHeader,textlines)
```

Put data on database online

```
if registerOnline:
        sqlcmd="INSERT INTO "+table+" (idtime,"+sHeader+") \
        VALUES ('"+values[0]+"',"+sValues+")"
        print(sqlcmd)
        try:
            cur.execute(sqlcmd)
            cur.execute("commit")
            print("OnLine inserted")
        except:
            print("Retrying insert (duplicate key?)..")
            conn = pymysql.connect(host=host, port=3306, user=user, \
             passwd=password, db=database)
            cur = conn.cursor()
            cur.execute("use "+database)
```

PyGrabDavis testdrive

- Edit command file for logging to CSV
- Run the logging in a few minutes
- Import CSV file with MySQL Workbench
  - Create database and table
- Check **idtime** key and convert it to tame datetime
- Edit the other columns so that they are big enouhg to hold extreme values
- Edit the command file for logging to database

Excercise

- Work in groups
- Gather information from 2 weather stations at different places on the globe and store in a table
  - URL, location, What kind of data, GPS position etc
- Run data logging for a period
  - Check that the logging works
- Later: Analyse common data