

# Development of low-cost flow sensors using accelerometers

## WATEF – 6<sup>th</sup> Sep 2018

Centre for Water Systems  
University of Exeter

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Second Supervisor: Dragan Savic  
Industry Partner: South West Water



# Flow logger (aggregate, not accelerometer based)



Meter with pulse unit attached

Data logger

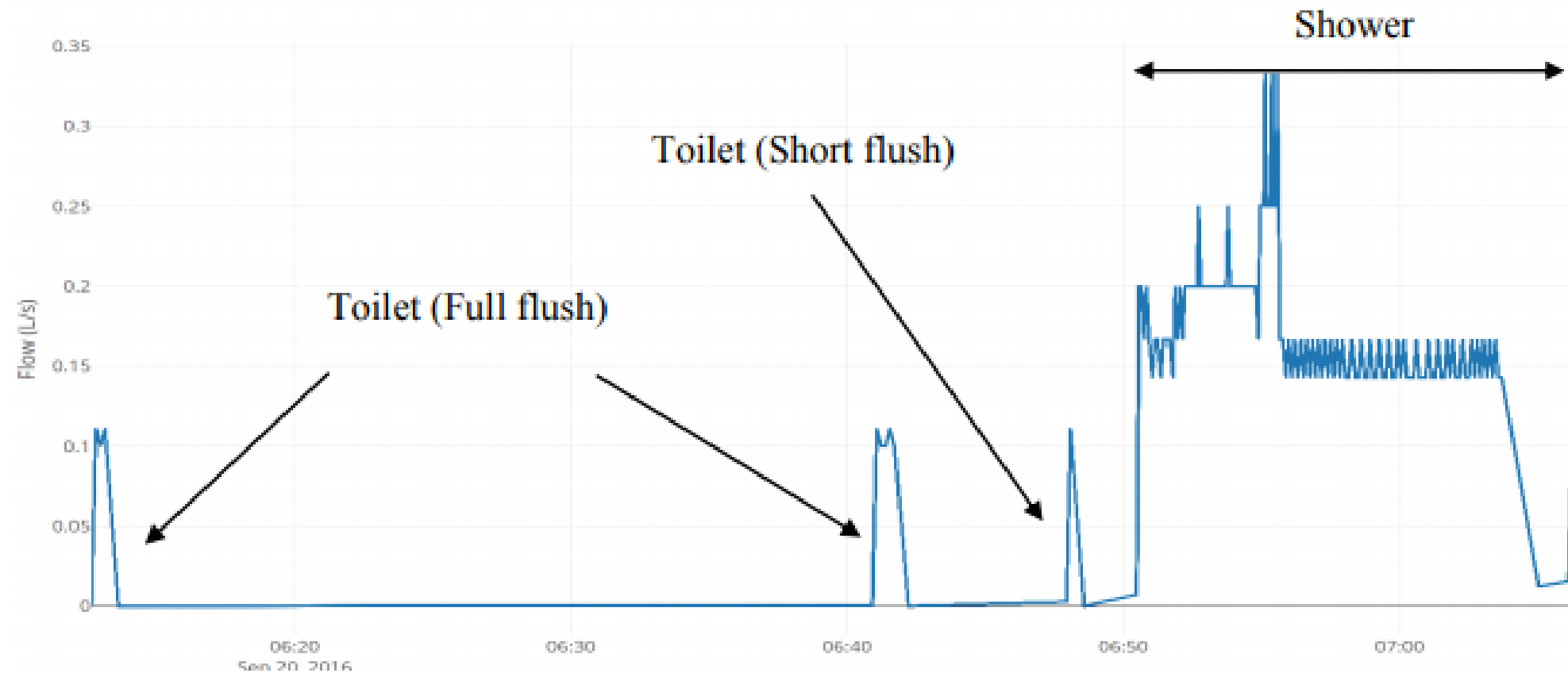
## Statistics:

- 1 Litre volumetric resolution.
- 1 Hz sampling rate.

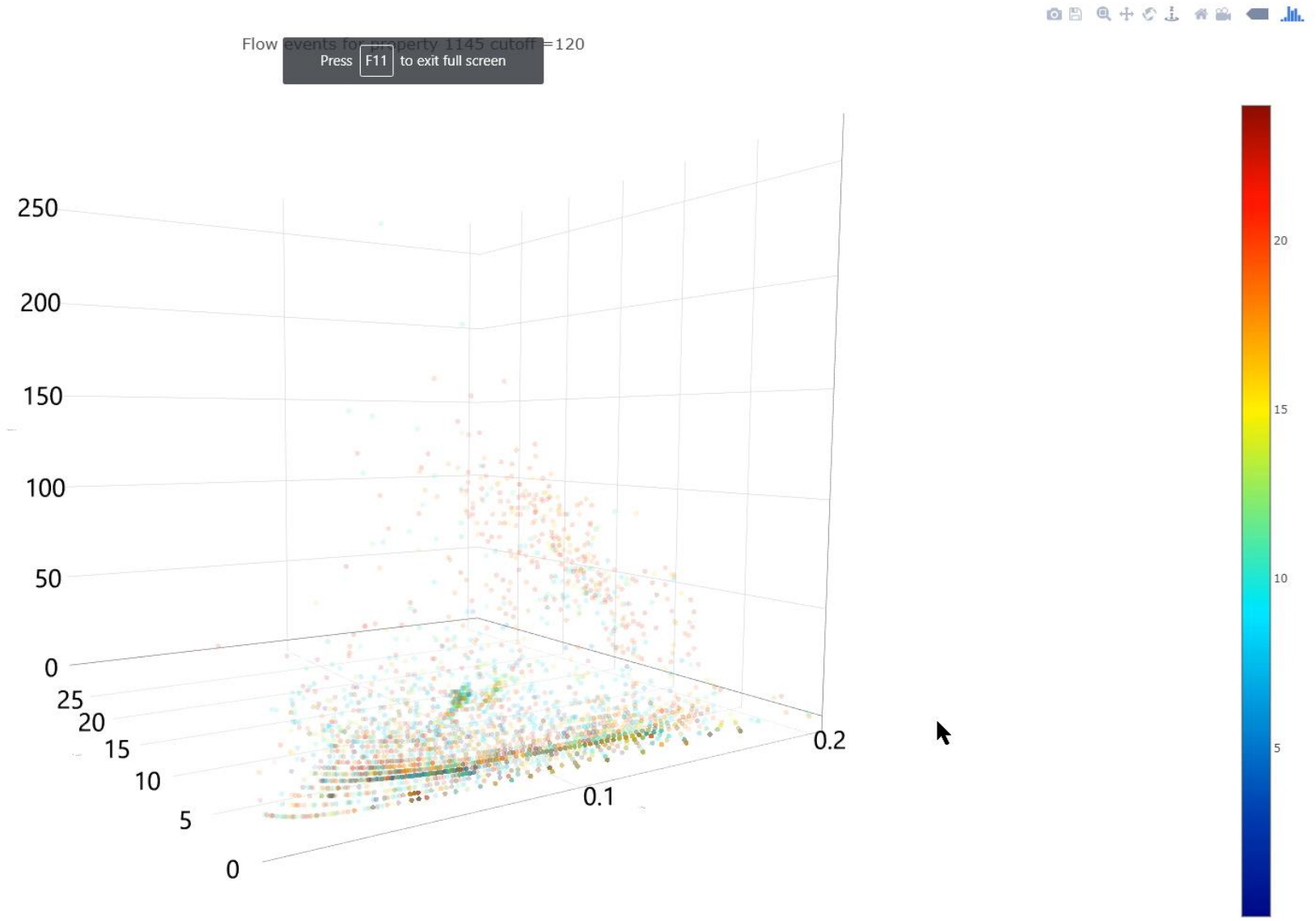
# Flow trace



# Example – Flow Trace



# 5-D Visualisation of flow trace events



Experimental setup:  
Total cost less than  
£25

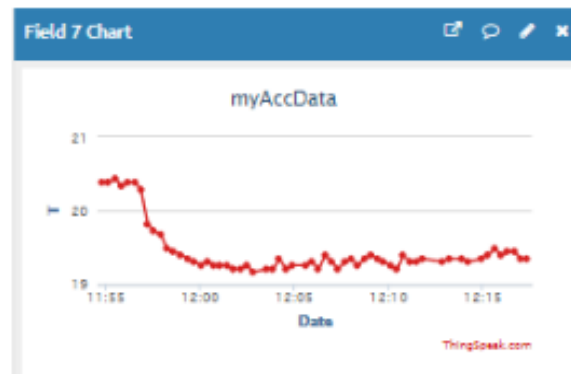
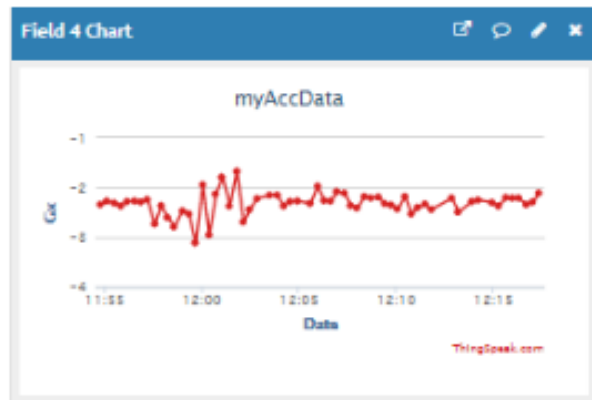
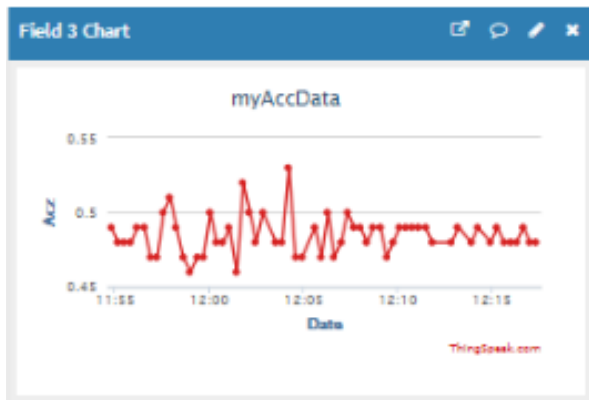
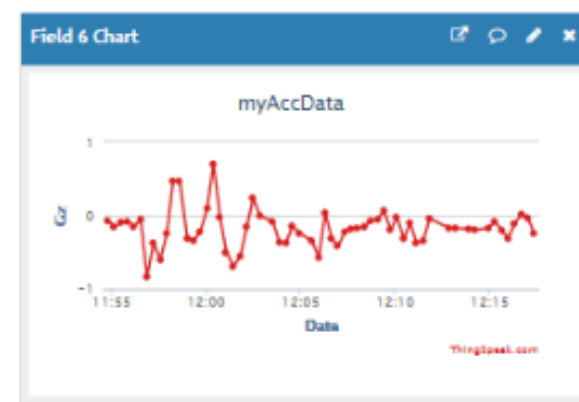
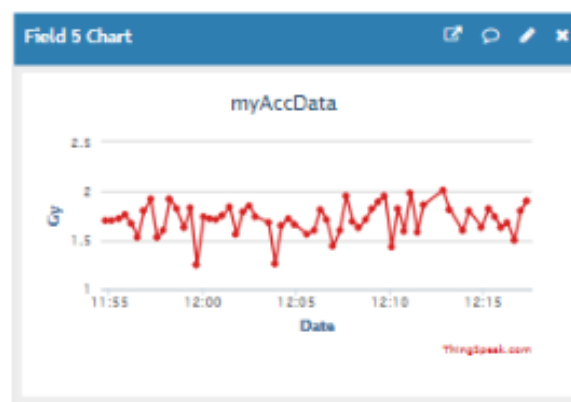
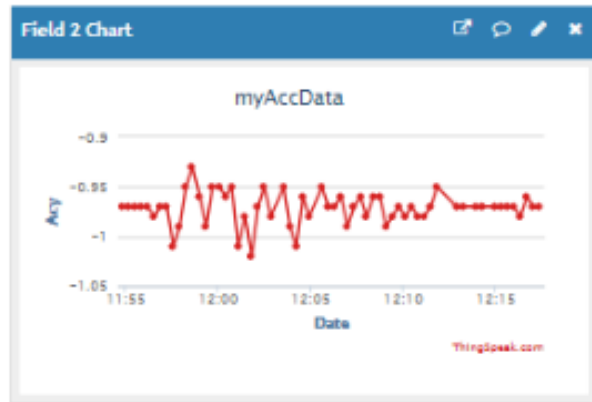
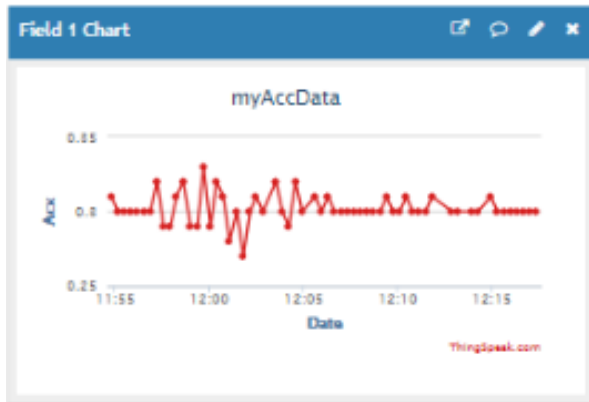


Accelerometer

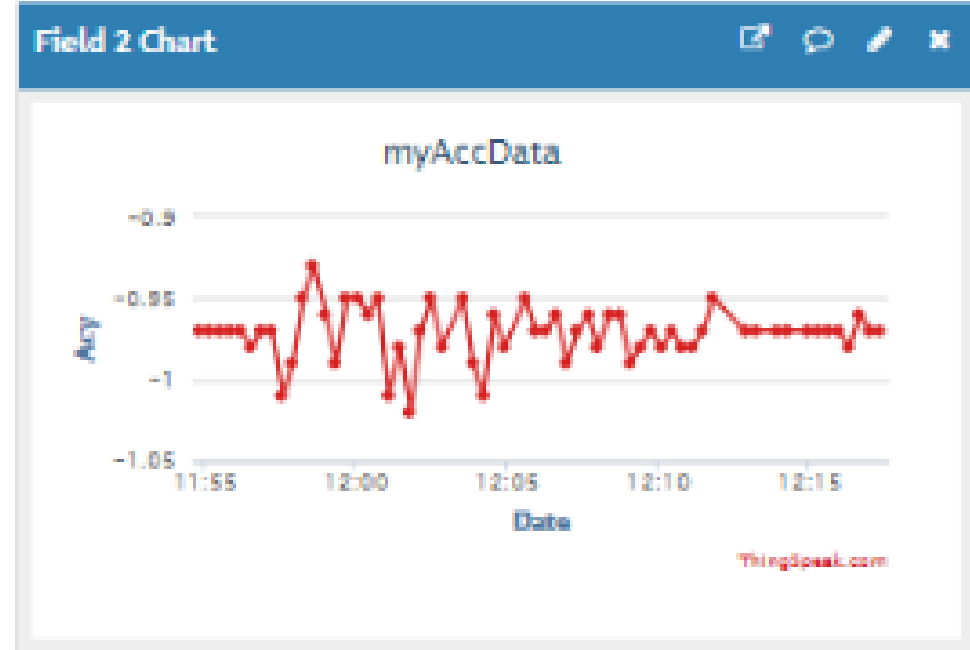
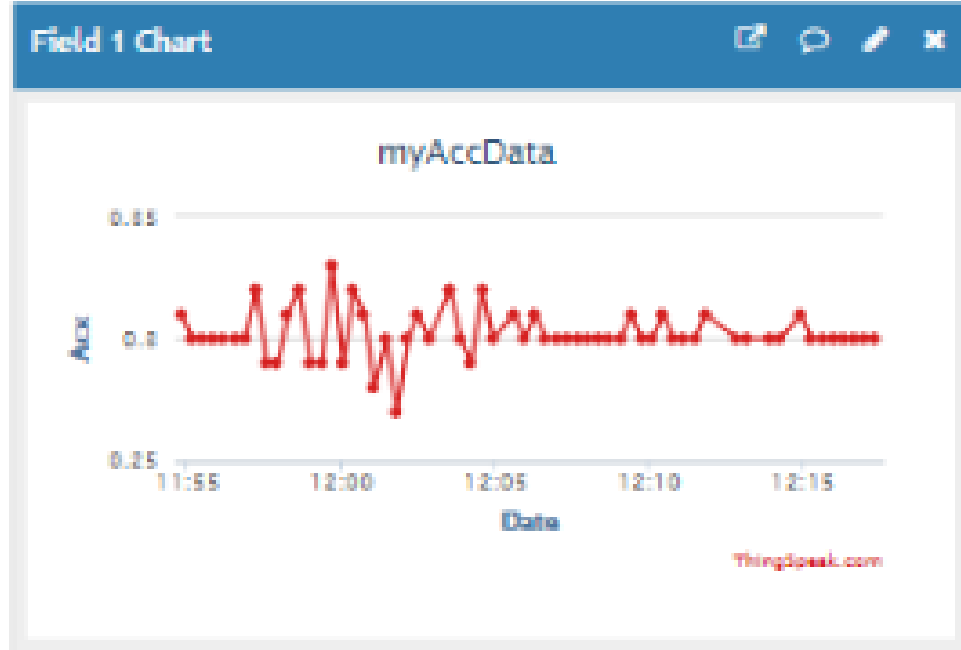
Wi-Fi board

Battery

# Variable Tap Flow Data (20 sec sampling)

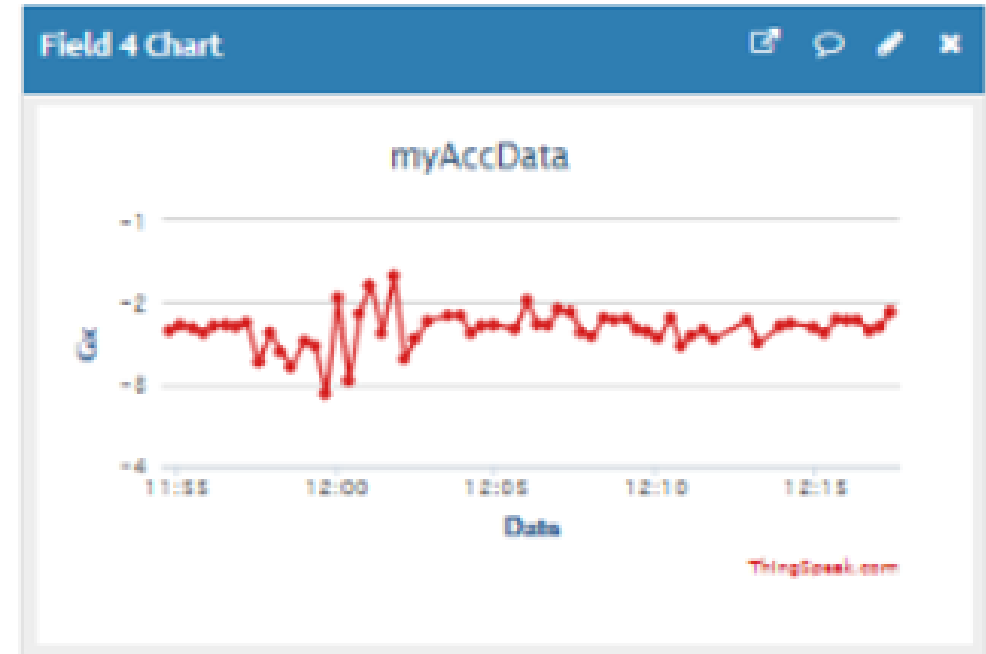
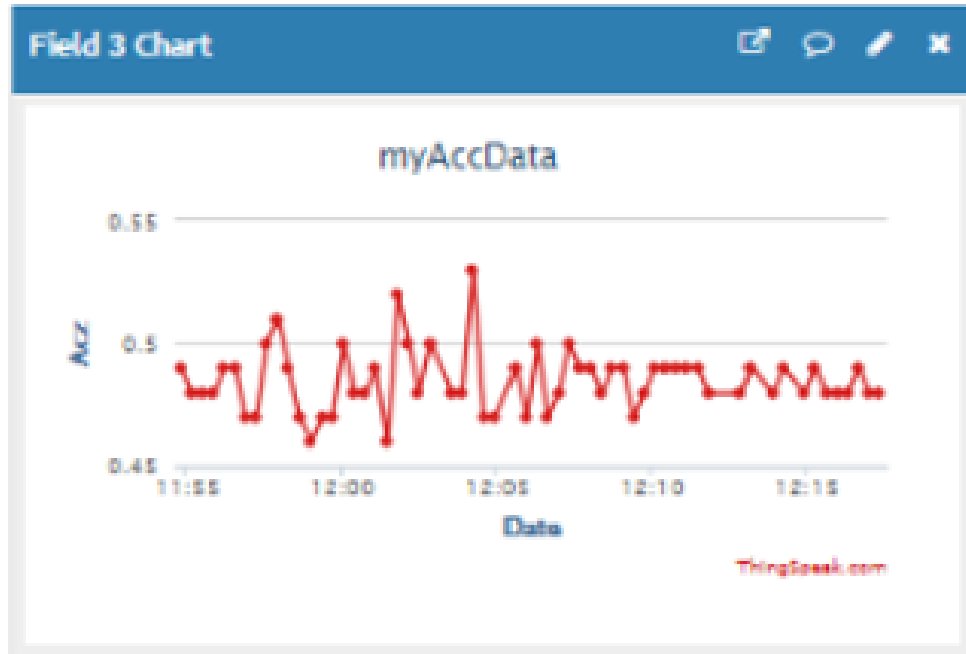


# Accelerometer X,Y

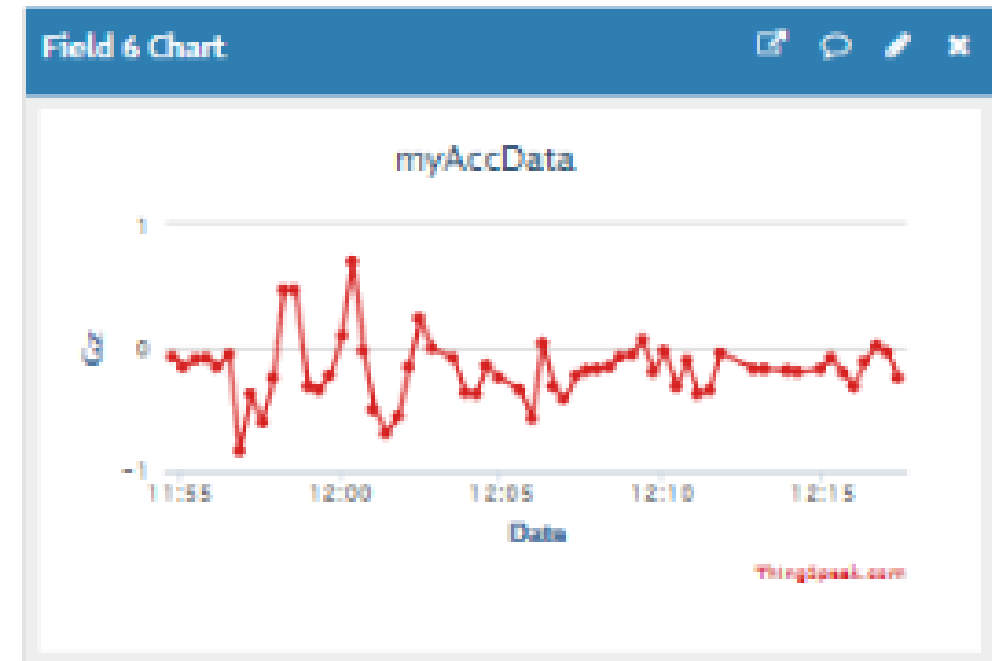
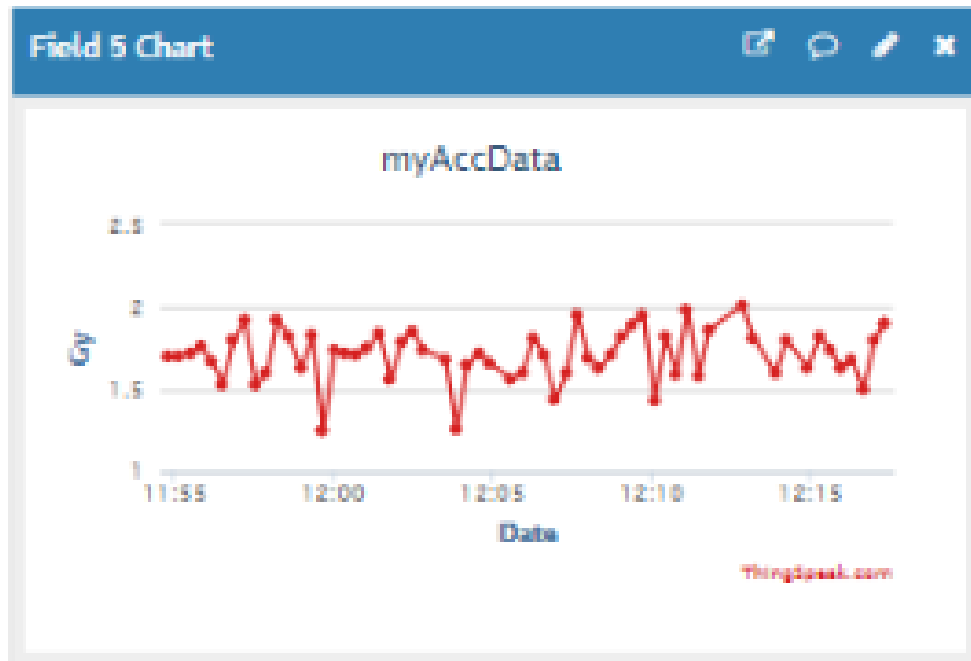




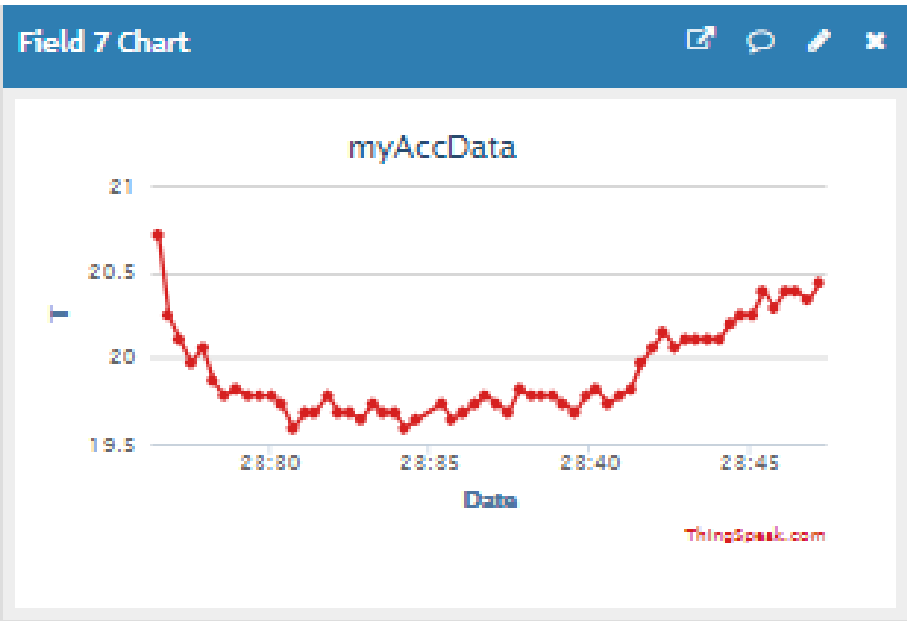
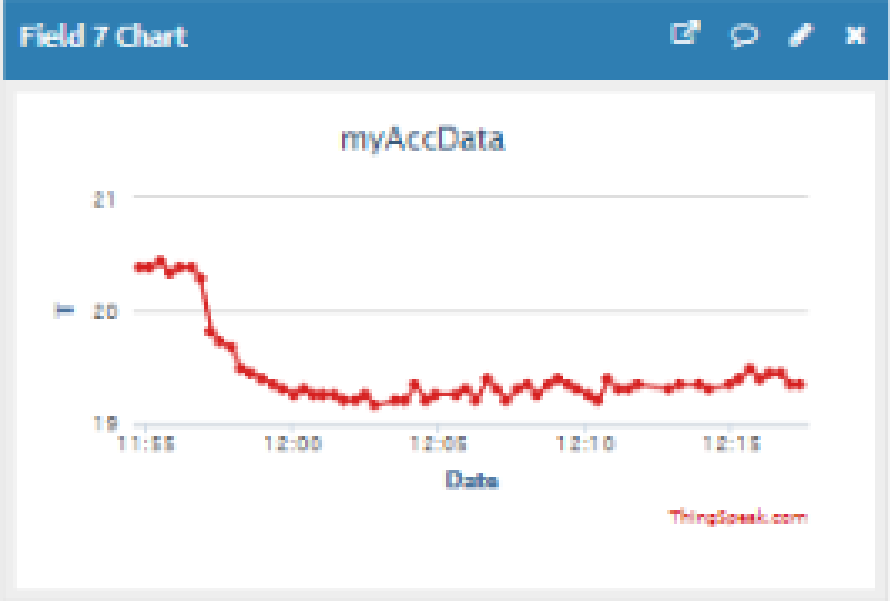
# Accelerometer Z, Gyro X



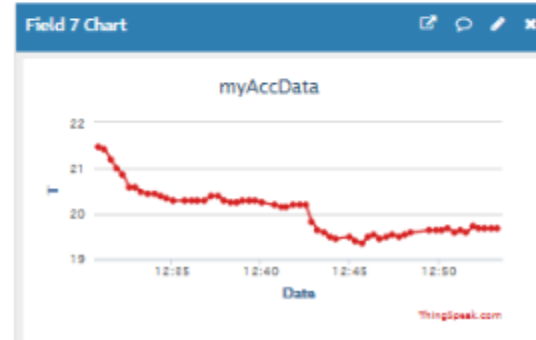
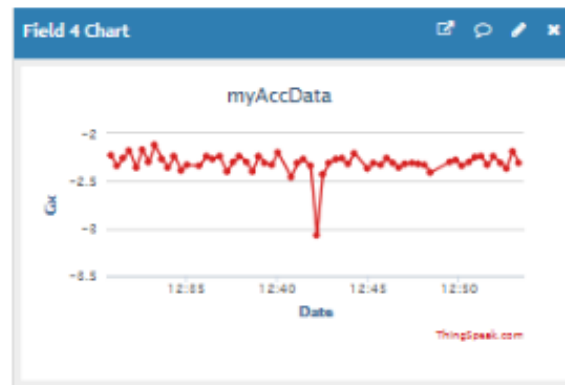
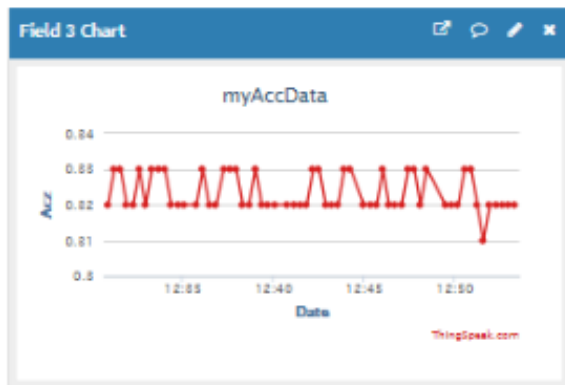
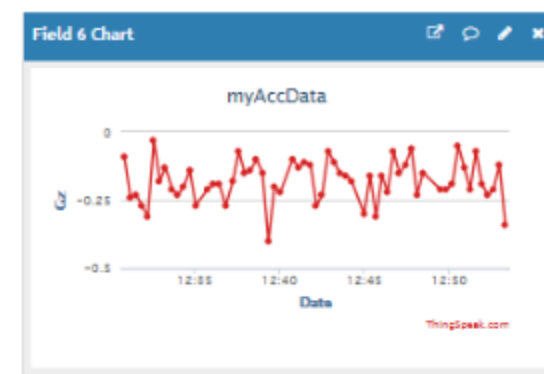
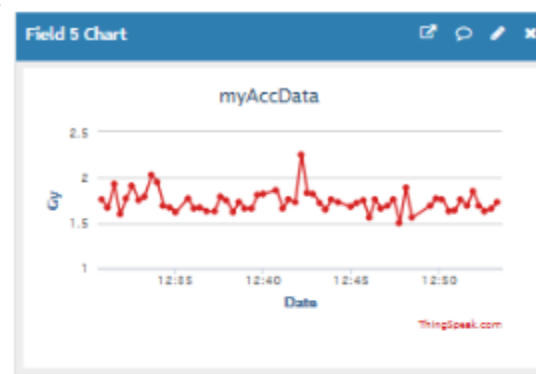
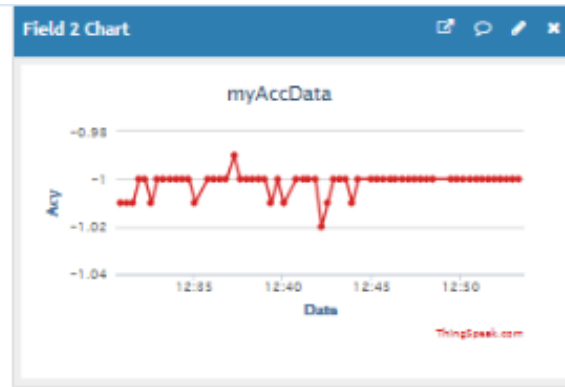
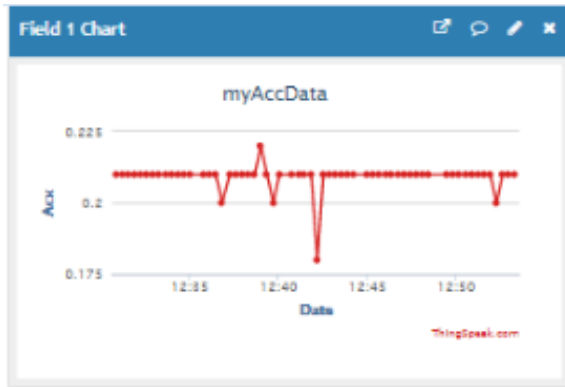
# Gyro Y,Z



# Temperature, 2 examples.



# Toilet Flow Data (20 sec sampling)



## Final Remarks

- Goal is to validate flow consumption that has been divided into end-uses.
- Event trigger well defined by temperature but multiple events may rely on accelerometer and gyro values
- Potential to combine the aggregated flow sensor outside the house and the sensors inside, to create a neural network model for predicting end-use.
- Low flow events harder to detect on accelerometer/gyro.
- Erratic nature of turbulence and sensor noise create difficulties in measuring flow with this sensor.

If you feel shy, feel free to email me to ask anything!

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