Sustainability in Archives:

Technological Revolution

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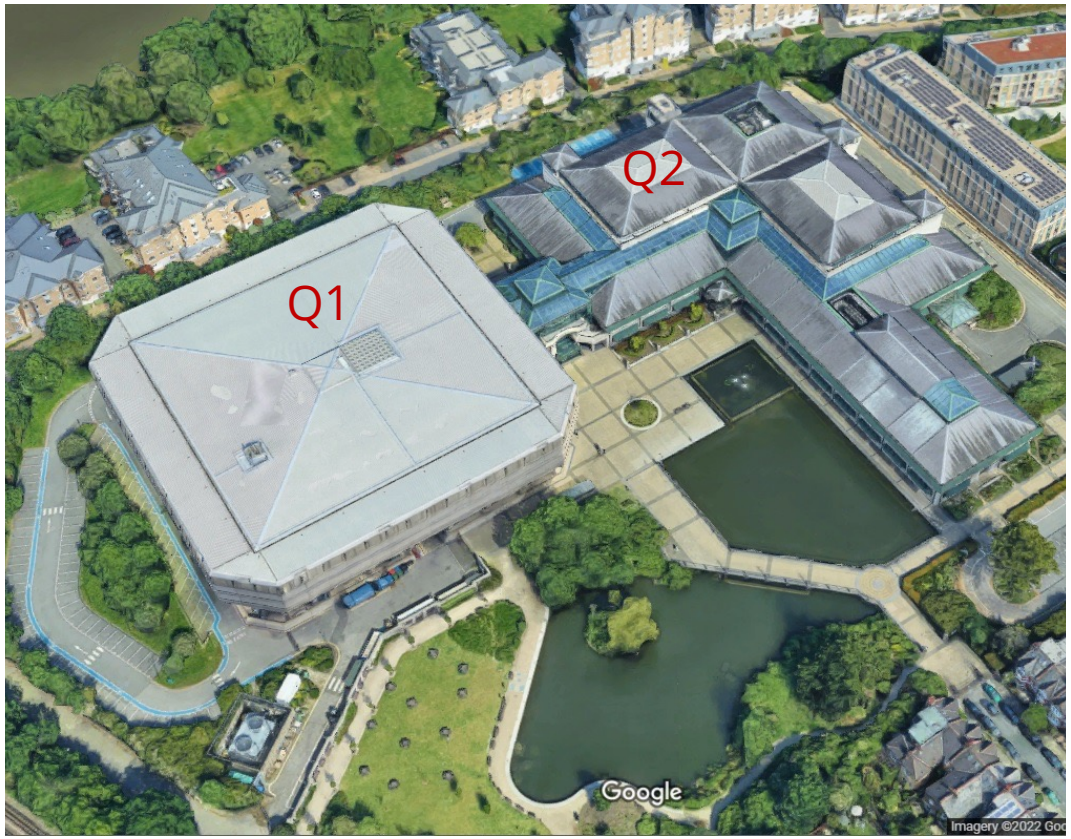
TNA Facilities



Source: Google Maps

Hanwell Sensors

A grid of c. 200 sensors monitor temperature and relative humidity across the different floors of the buildings.

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Building Environment Simulation Project (UCL, 2010)

Seasonal Drift

TEMP	Range (CCD)		Level (BMS)	
	Low	*High*	*Low*	*High*
January	16	18	14.5	19.5
February	16	18	14.5	19.5
March	16.5	18.5	15	20
April	16.5	18.5	15	20
May	17	19	15.5	20.5
June	17.5	19.5	16	21
July	18.25	20.25	16.75	21.75
August	18.75	20.75	17.25	22.25
September	19	21	17.5	22.5
October	17.5	19.5	16	21
November	16	18	14.5	19.5
December	16	18	14.5	19.5

RH	Range (CCD)		Level (BMS)	
	Low	*High*	*Low*	*High*
January	35	50	32	53
February	35	50	32	53
March	35	50	32	53
April	35	50	32	53
May	40	55	37	58
June	40	55	37	58
July	41.25	56.25	38.25	59.25
August	41.25	56.25	38.25	59.25
September	41.25	56.25	38.25	59.25
October	40	55	37	58
November	35	50	32	53
December	35	50	32	53

Reductions operating HVAC system

Current Challenges

Collection Care Management and its Modernization:

1 Hanwell environmental monitoring outdated and sensors are becoming obsolete;

2 High amount of data for processing and space performance evaluation;

Energy Costs Reduction:

3.1 Windows replacement project;

3.2 HVAC system shutdown project;

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Mitigation – New System of Sensors LoRaWAN IoT

- Temperature
- RH
- Light
- Motion
- Battery
- Co2
- VOC

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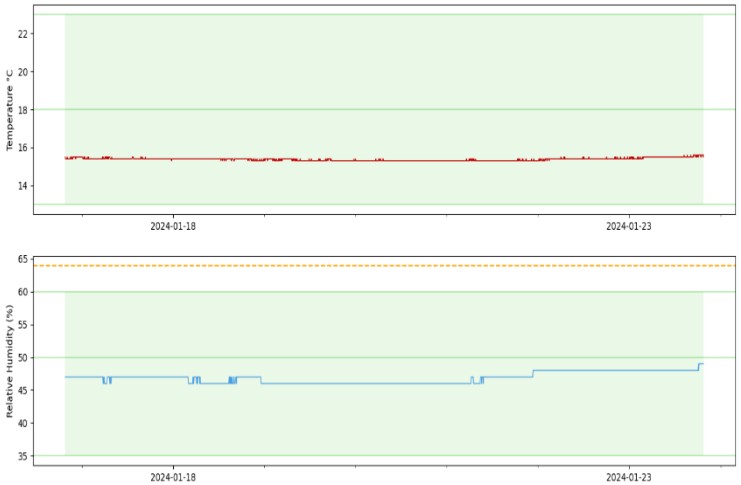
Mitigation – AI tools - Python Coding

```
    with open(user_input+"report.txt", "a") as f:
        f.write("\n\nReport for " + sheet)
        f.write('\n'+Trequirements)
        f.write("\nYour temperature is out of range " + str(t_ratio1) + "% of time.")
        f.write("\nYour average temperature is " + str(taverage) + "°C.")
        if taverage < 18:
            f.write("\nDuring the analysed period, your average storage temperature is below 18.")
        else:
            f.write("\nDuring the analysed period, your average storage temperature is above 18.")
        f.write("\nAccording to BS 4971-2017:\n"
          "Relative Humidity should not fall below a minimum of 35% or exceed a maximum of 60%.")
        f.write("\nYour RH is out of range " + str(RH_ratio) + "% of time.")
        if RH_ratio64 != 0:
            f.write("\nThe percentage of time your RH is above 64% is " + str(RH_ratio64) +
                    "%. This substantially increases the risk of mould in your collection"
                    " as mould generally begins to reproduce at a RH of the air of 65% or higher.")
        else:
            f.write("\nYour RH is always below 64%.")

    # Print on python what report is generating
    print(Trequirements)
    print("Your temperature is out of range", t_ratio1, "% of time.")
    print("Your average temperature is", taverage, "°C.")
```

```
According to BS 4971-2017:
Temperatures should not fall below a minimum of 13°C or exceed a maximum of 23°C.
The annual average storage temperature should be less than 18°C.
Your temperature is out of range 0.0 % of time.
Your average temperature is 15.38 °C.
During the analysed period your average storage temperature is bellow 18.
According to BS 4971-2017:
Relative Humidity should not fall below a minimum of 35% or exceed a maximum of 60%.
Your RH is out of range 0.0 % of time.
Your RH is always below 64.%
```

- Automated data processing
- Report Generation
- Comparison with BS 4971-2017
- Automated graph generation



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Mitigation – Testing changes to the building/HVAC

Approach:

1 Compare environmental data before and after changes;

2 Statistical analysis;

3 Evaluation of microclimates;

4 Environmental alarms where an action is needed;

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Long Term Plan - 3D Digital Twin

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