Questions

a) the RIP and accelerometer give good correlation, why is the same not true with the other measurements CO2 and temperature? You claim noise and outliers but then why not noise and outliers on RIP and accelerometer?

- A possible reason for the weaker correlation between CO2, temperature, and the other measurements (RIP and accelerometer) could be a slight phase difference. This difference may not be due to the sensors being slower but rather the sensors requiring some time to adjust from room CO2/temperature levels to breath levels, causing a "heating up" effect after breathing on them. In contrast, the response of the accelerometer and RIP is almost instantaneous. To analyse this theory further, I could apply small incremental time shifts representing delays to the CO2/temperature/accelerometer data. By recomputing the correlation with the RIP at each small shift, if the hypothesis stands, the optimal shift for CO2/temperature should be higher than that of the accelerometer.
- Another reason for the weaker correlation could be the higher fluctuation of background temperature and CO2 compared to the accelerometer. If I remain still, the normalized acceleration (excluding g) should be zero. However, in the case of temperature and CO2, even when not breathing and measuring room values, the values could still fluctuate due to factors like air circulation in the room and heating settings. To analyse this hypothesis, I could measure the white noise of CO2/temperature/accelerometer data and create distributions for each. By comparing the variances of these distributions, if the relative variance for CO2 and temperature is significantly higher, the hypothesis would hold true.
- A final reason could be that the data for CO2 and temperature had not converged to breath values. Initially, the data for CO2 and temperature are at room values, and as breathing continues, they fluctuate during inhales/exhales but show an upward trend. In contrast, acceleration defaults to a value of zero and does not need to converge to any specific value. To evaluate if this is true, I could simply measure the CO2 and temperature data for a longer period with increments and recompute correlation for each longer period (e.g 30s, 60s, 90s, 120s… of data), if the correlation continues to increase with more data, the theory may be true because when measuring the data for longer periods the original settling time is diluted.

b) in future work you write "investigating new relationships between health parameters and respiratory health conditions/indicators" what new relationships would you investigate and how?

- One potential relationship briefly discussed in Section 8.1 of the report was the usage of the Short Time Fourier Transform (STFT) on the Respiratory Inductance Plethysmography (RIP) data, a technique which has not been extensively explored. As per the report's guidance, we could implement the STFT by applying Fourier transforms within a small, sliding window of the data. My hypothesis posits that a person's respiratory health may be influenced not only by their breathing rate, which indeed has a significant impact, but also by minor variations in their breathing. For instance, the Fourier transform can highlight changes in the amplitude and frequency content of the breathing signal during episodes of apnoea. To conduct this research, we could potentially study both healthy volunteers and those with respiratory conditions, such as sleep apnoea, and analyse the content of the STFTs. When extracting features for study, we could focus on common STFT features like spectral centroid (the average frequency of the signal) and spectral contrast (the difference in magnitude between peaks and valleys in the spectrum), among others. It's crucial to extract these significant features, as without them, the analysis could become overly complex due to the dynamic nature of the graphs.