The results section presents the findings from the analysis of the accelerometer data collected during the simulated intrusion attempts on the MediColbox. The accelerometer data provides insights into the physical movements and vibrations experienced by the MediColbox during these intrusion scenarios.

A. Analysis of Accelerometer Data

The accelerometer data captured the accelerative patterns resulting from different simulated intrusion attempts, including striking, dropping, sawing, and shaking the MediColbox. The data analysis focused specifically on the accelerometer readings to evaluate the sensitivity and effectiveness of the IMU in detecting unauthorized access.

1) Striking the MediColbox: Figure 1 presents the accelerometer data recorded when the MediColbox was struck with a fist. The accelerometer readings showed a sharp increase in acceleration followed by a swift, but gradual decrease as the impact dissipated. The peak acceleration value reached during the strike was measured at $X = 5[m/s^2]$, $Y = -31[m/s^2]$, $Z = -55[m/s^2]$ and occurred at $t = 0.8[s]$. The analysis of the data indicates that the IMU successfully detected and recorded the impact caused by the striking event.

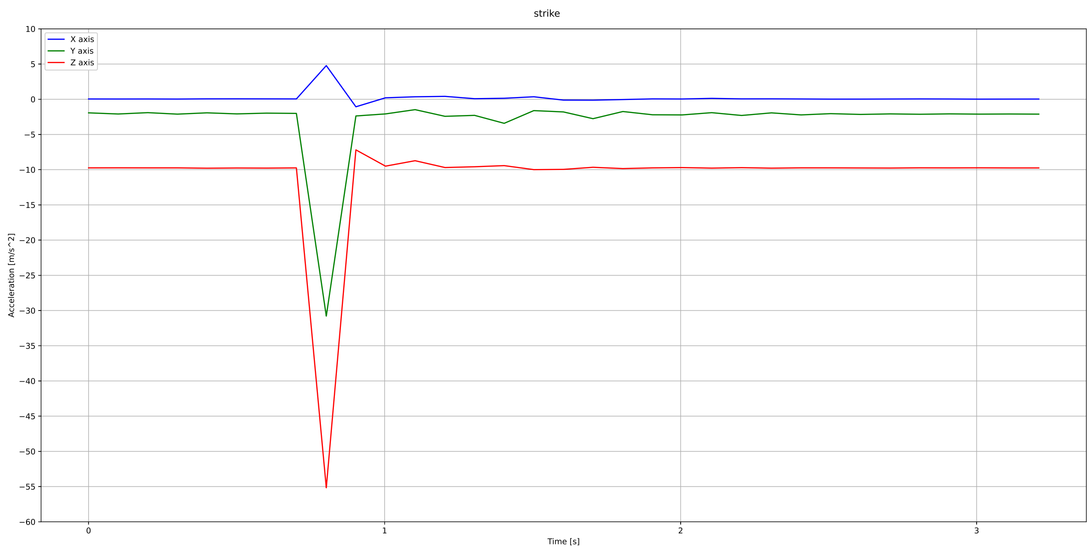

Fig. 1. Accelerometer data during the striking event

The Fourier analysis of the accelerometer data during the striking event is shown in Figure 2. The Fourier analysis allows us to examine the frequency components present in the accelerometer readings and provides insights into the characteristics of the impact and resulting vibrations. By analyzing the frequency distribution and identifying prominent peaks or patterns in the frequency domain, we can gain a deeper understanding of the dynamic response of the MediColbox to external forces.

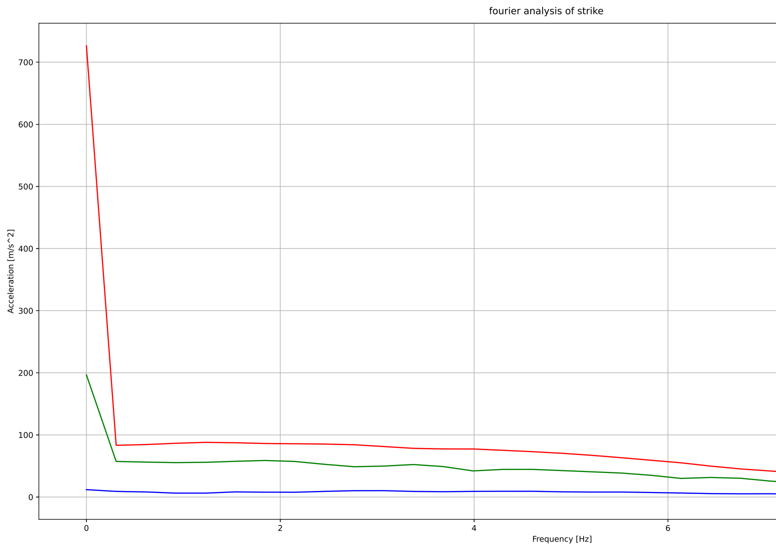

Fig. 2. Fourier analysis of accelerometer data during the striking event

2) Dropping the MediColbox: The accelerometer data collected when the MediColbox was dropped from a table is presented in Figure 3. The data showed a sudden increase in acceleration when the MediColbox was released, followed by a deceleration as it came into contact with the surface. The maximum acceleration value recorded during the drop was $X = -7.7[m/s^2]$, $Y = 35[m/s^2]$, $Z = -50.7[m/s^2]$, which occurred at $t = 5.1[s]$. The analysis confirms that the IMU effectively captured the acceleration changes associated with the dropping event.

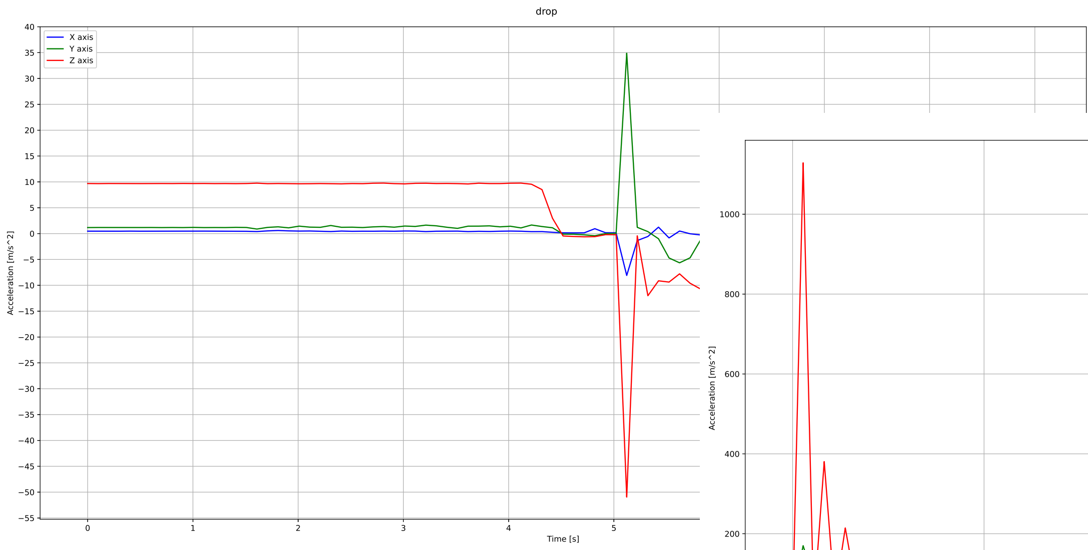

Fig. 3. Accelerometer data during the dropping event

The Fourier analysis of the accelerometer data during the dropping event is shown in Figure 4. The Fourier analysis allows us to examine the frequency components present in the accelerometer readings and provides insights into the characteristics of the drop and resulting vibrations.

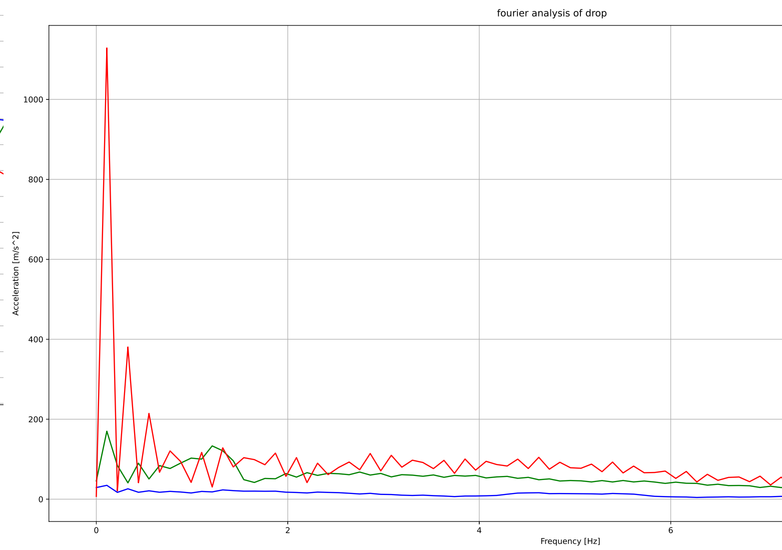

Fig. 4. Fourier analysis of accelerometer data during the dropping event

3) Sawing on the MediColbox: Figure 5 illustrates the accelerometer data recorded while sawing on the MediColbox using a metal cutting saw. The data exhibited periodic variations in acceleration corresponding to the back-and-forth sawing motion. The analysis of the data indicated a consistent pattern of acceleration changes during the sawing event. This suggests that the IMU was able to capture the vibrations and oscillations caused by the sawing action.

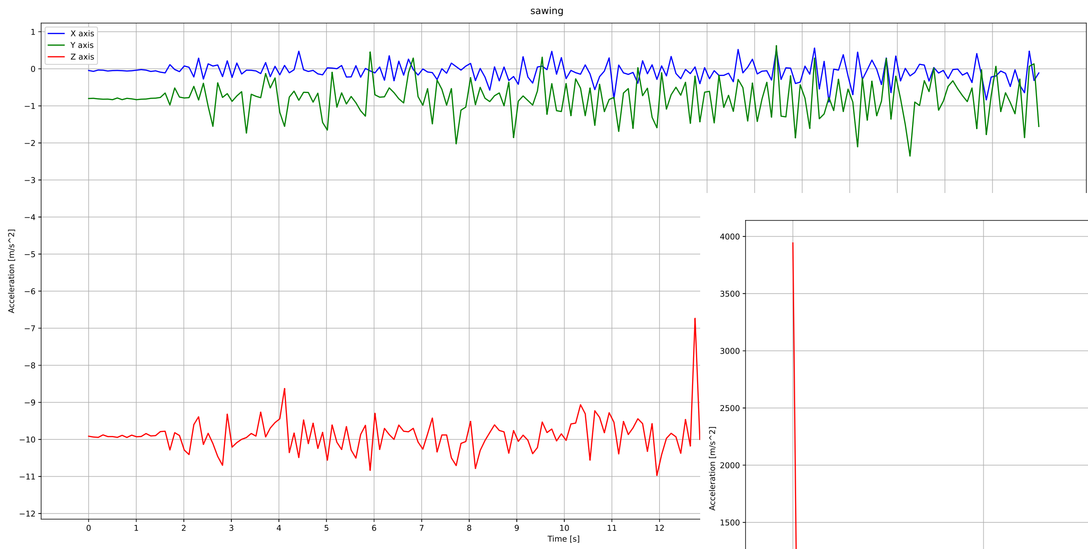

Fig. 5. Accelerometer data during the sawing event

The Fourier analysis of the accelerometer data during the sawing event is shown in Figure 6. The Fourier analysis allows us to examine the frequency components present in the accelerometer readings and provides insights into the characteristics of the sawing action. By analyzing the frequency distribution and identifying prominent peaks or patterns in the frequency domain, we can gain a deeper understanding of the dynamic response of the MediColbox to the sawing forces.

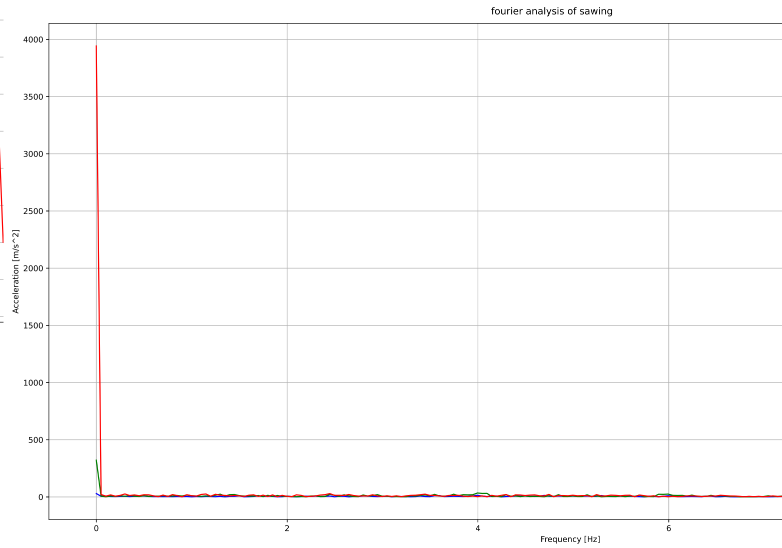

Fig. 6. Fourier analysis of accelerometer data during the sawing event

4) Shaking the MediColbox: The accelerometer data obtained while shaking the MediColbox on a sifter, simulating cutting it with an angle grinder, is presented in Figure 7. The data exhibited irregular and rapid fluctuations in acceleration due to the shaking motion. The analysis of the data demonstrated that the IMU was sensitive enough to detect and record these rapid changes in acceleration, indicating its potential for detecting unauthorized access attempts involving similar movements.

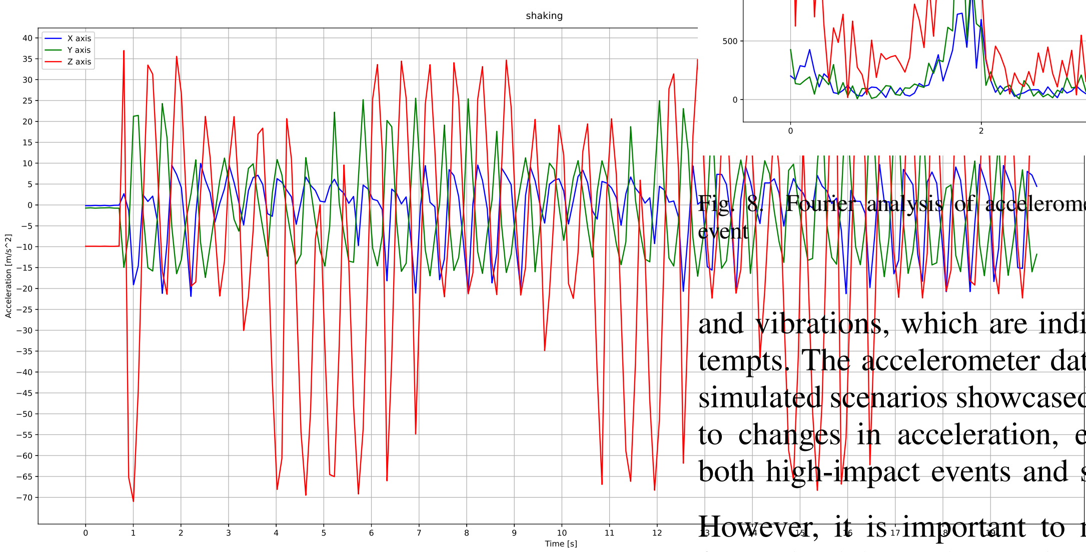

Fig. 7. Accelerometer data during the shaking event

The Fourier analysis of the accelerometer data during the shaking event is shown in Figure 8. The Fourier analysis allows us to examine the frequency components present in the accelerometer readings and provides insights into the characteristics of the shaking motion. By analyzing the frequency distribution and identifying prominent peaks or patterns in the frequency domain, we can gain a deeper understanding of the dynamic response of the MediColbox to the shaking forces.

B. Discussion of Findings

The analysis of the accelerometer data during the simulated intrusion attempts provides valuable insights into the IMU's ability to detect and capture unauthorized access events. The results demonstrate that the accelerometer readings accurately captured the accelerative patterns associated with striking, dropping, sawing, and shaking the MediColbox.

The findings suggest that the IMU is a reliable and effective sensor for detecting physical movements

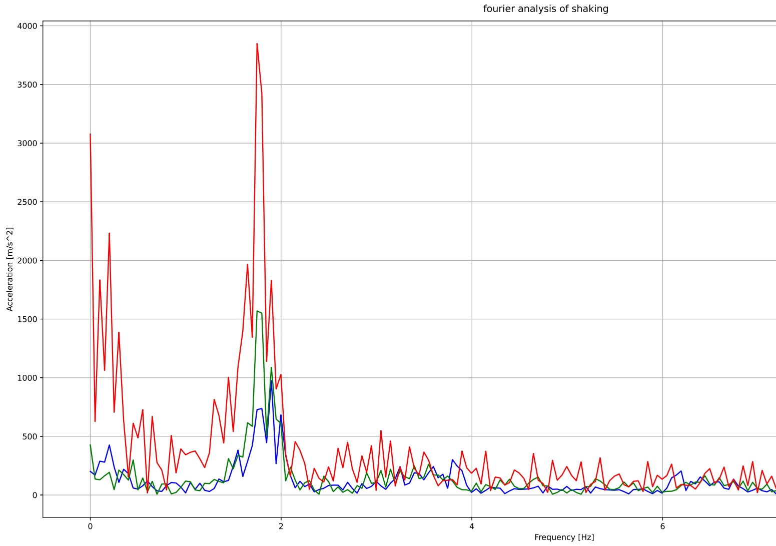

Fig. 8. Fourier analysis of accelerometer data during the shaking event

and vibrations, which are indicative of intrusion attempts. The accelerometer data recorded during the simulated scenarios showcased the IMU's sensitivity to changes in acceleration, enabling it to capture both high-impact events and subtle vibrations.

However, it is important to note that the analysis focused solely on the accelerometer data, and other data collected by the IMU, such as gyroscope or magnetometer readings, were not considered in this study. Further research could explore the integration of multiple sensor data to enhance the accuracy and robustness of intrusion detection.

Overall, the results indicate the potential of the IMU as a standalone solution for intrusion detection on the MediColbox. The findings support the feasibility of utilizing the IMU to enhance the security and protection of the MediColbox by effectively detecting and alerting on unauthorized access attempts.