

# **Combining Ultra-Wideband (UWB) Location and Accelerometer data for Cattle Behaviour Monitoring**

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## **ABSTRACT**

Precision Livestock Farming (PLF) technologies build on the collection and processing of reliable real-time data at the individual level to efficiently classify animal behaviours for improved monitoring and management systems. The current accelerometer-based systems can monitor only a limited number of behaviours, such as feeding and ruminating (neck collar sensors) or lying and standing (leg sensors). Moreover, the accuracy of detection of behaviours that are less frequently expressed in animals, such as walking or drinking, remains a challenge. The aim of this study was to present a novel efficient method to incorporate indoor location and accelerometer data for improved cattle behaviour monitoring systems. In total, 30 dairy cows were fitted with Pozyx tracking tags (Pozyx, Ghent, Belgium) on the upper (dorsal) side of the cow's neck. A total of 123 hours of video recordings were used for validation. Bland–Altman plots for the correlation and difference between the estimated behaviours (sensors) and the ground-truth behaviours (video) were computed for the performance analysis. In overall, the location-based classification into the correct functional areas was very high ( $R^2=0.99$ ,  $P<0.001$ ). The combination of location and accelerometer data improved the RMSE per bout of the feeding time and ruminating time compared to the accelerometer data alone (2.6 to 1.4 min). Moreover, the combination of location and accelerometer enabled accurate classification of additional behaviours that are difficult to detect using the accelerometer alone, such as eating concentrates and drinking ( $R^2 = 0.85$ , and  $0.90$ , respectively). This study demonstrates the potential of combining accelerometer and UWB location data for designing a robust monitoring system for dairy cattle.