[6-1130-P] Other Categories (6th)
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11:30 AM - 12:30 PM

[6-1130-P-15] Sound Source Localization in Pig Houses Using Wireless Microphone Array and Its Accuracy by Microphone Arrangements

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The recent increase in breeding density due to intensive management of swine leads to an expanding risk of highly infectious respiratory infections. In particular, Porcine Reproductive and Respiratory Syndrome (PRRS) is the main factor inhibiting production in swine farming. Thus, early detection of PRRS is an essential issue in the management of group-housed livestock. In order to achieve early detection, our research group developed a system to detect PRRS automatically. The developed system utilizes a relationship that a frequency of cough and sneezing in swine increases as it is infected by disease, and monitors the sounds in a pig house using multiple microphones to localize the sneezing swine. However, the wiring to connect microphones has been a barrier to deploy a system in pig houses. In this study, we developed a monitoring system using wireless microphones to make the system deployment more flexible. On deploying the wireless monitoring system to a large space, the degradation of the communication quality affects detection of sneezing sound and sound source localization. Therefore, we examined a relationship between an installation position of the wireless microphones and the localization accuracy. Specifically, sound source localization was performed using developed wireless microphones and sound source that emits an actual sneezing sound of swine by changing two parameters: the source-microphone distance (l), and the microphone-receiver distance (d). The obtained results suggest that the measurement error increases as the source-microphone distance (l) increases, while measurement error did not change although the microphone-receiver distance (d) increases. The first result indicates that the localization accuracy was enough (within 0.4 m) when (l) is 4 m or less, and the second result indicates that the wireless microphones can be deployed in a large space. We also deployed the proposed wireless acoustic wave sensor in a pig house to perform a two-week swine influenza infection experiment. In this experiment, the source-microphone distance (l), and the microphone-receiver distance (d) were set as 2 m and 3 m, respectively. We found that the proposed sensor works for two weeks and can localize the sneezing swine within an accuracy of 0.2 m.