SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA15134
STSM title: Automatic tracking systems for poultry activity
STSM start and end date: 29/10/2018 - 03/11/2018
Grantee name: Lisa Jung

PURPOSE OF THE STSM:

Today, animal welfare is one of the main topics in farm animal husbandry. It can be defined as the ability to successfully cope with the environment and the possibility to summarize positive emotions, in addition to the absence of pain, suffering and physical harm. Consequently, any limitation to active and successful interaction with the environment may impair animal well-being (Knierim, 2001). The key challenges concerning animal welfare in poultry are the prevention of leg weakness in broilers (Bessei, 2006), feather pecking and cannibalism in turkeys (Dalton et al., 2016) and laying hens (Jung and Knierim, 2018), as well as keel bone damage in laying hens (Heerkens et al., 2016). In addition to the assessment of animal based indicators, like plumage or integument condition, information could be gained by behavioural observations. Tracking systems offer the possibility to focus on individuals and track their activities across time and space with minimal disruption. Individual tracking systems have been used e.g. to investigate ranging (Richards et al. 2012; Gebardt-Henrich et al., 2014) and nesting behavior (Siegford et al., 2016) in laying hens, locomotion in broilers (Stadig et al., 2017) or behaviour in dairy cattle (Porto et al., 2014). Hence, individual tracking systems can be used for diverse research questions.

This STSM was implemented within the PhD project of Malou van der Sluis, where an active Ultra Wideband system (UWB; TrackLab, Noldus Information Technology, Wageningen, The Netherlands) is used to track individual activity of fast-growing broilers. This software can visualize the movements of animals over time and can calculate total distances, speed, and other variables. The aim of the STSM was to gain knowledge on how Ultra-Wideband systems cam be used for activity measurement in poultry and how data correction influences the results. During the visit a new tracking round was started, whereby handling and installing of the setup was explained. Additionally, it was calculated in howfar smoothing or cutting affects the recorded distances moved by individual animals.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

During the STSM we visited the animal facilities of Wageningen University & Research and two experimental breeding production farms. Additionally, we went to the Utrecht University where we worked on TrackLab data. The farm visits included marking with wing tags, taking of blood samples, weighing of animals, preparing the backpacks for the tracking system and data collection.

Animals and setup

In total 36 animals of a fast-growing strain were used for the experiment. Ultra-wideband backpacks were attached on the back of each animal and were tracked from 7:00 to 23:00 hours, 16 hours of continuous tracking. The tags could be made secure on the back of the broiler using a nylon elastic band behind the wings.

The pen of 310 cm by 225 cm was horizontally divided (Figure 1) for each a group of 'heavier' and 'lighter' fast-growing broilers. The pen was littered with wood shavings and two feeders and drinkers were installed at each side. The broilers had ad libitum access to feed and water. These data had been recorded in a pre-test and were available for the analyses during the STSM.

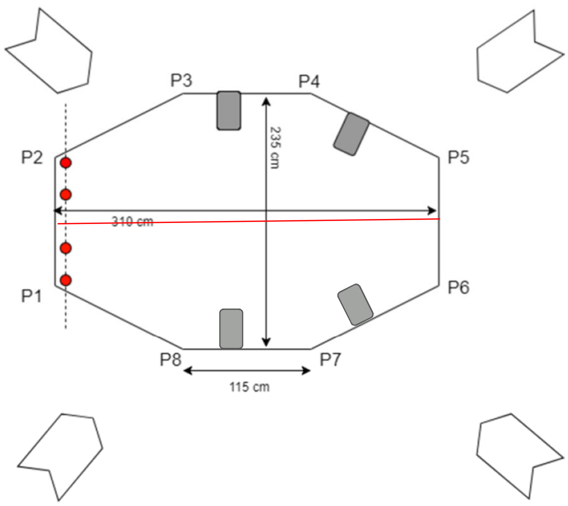

Figure 1 Pen parted in the horizontal line with four beacons

Figure 2 Backpack 3.5 cm x 3.5 cm, 25 grams

Ultra-Wideband system

UWB is a radio-technology for short range and uses high bandwidth communication (Mautz, 2012). The active battery powered UWB tags are attached on the back of the broilers. The tags send out a signal at a pre-set rate. This signal is received by four beacons that are placed in the upper corners of the room. The system was calibrated using one reference point in the middle of the pen. Using triangulation, based on the time of arrival and angle of arrival of the signal, we can determine the location of individual animals.

Analysis of the data

The data set was chosen to analyze different data corrections on the recorded distances moved by the tracked animals (Figure 3 shows the raw data). Smoothing estimated the real value of the track points by means of the weighted least square values and could be applied to varying extents. We choose the factors 5 and 11. With clipping zone, certain areas of the test-room virtually can be cutted. It is known that reflections of the signal can lead to an overestimation of the distances in the corners of the test-room. Data points recorded outside the corners of the test room were cutted (Figure 4). The applied data correction settings in our analyses were:

1. minimum track smoothing (smooth_5)
2. medium track smoothing (smooth_11)
3. clipping zone (zone)
4. clipping zone*minimum track smoothing (zone*smooth_5)
5. clipping zone*medium track smoothing (zone*smooth_11)

The track distances (m) resulting from these corrections were compared with the raw distances by ranking of the individual animals. Correlations between raw data and smoothed/cutted data were calculated. All data were exported from Tracklab to Excel.

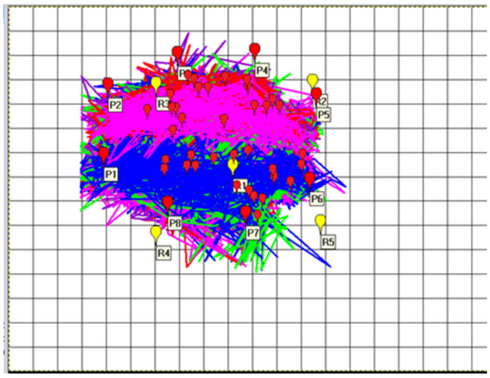

Figure 3 Raw data

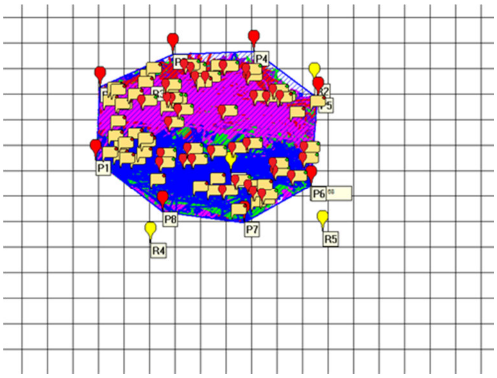

Figure 4 Cutted data

Results

The longest and the shortest raw distance moved differed 224 m during 16 h observation time. After smoothing_5 the longest and the shortest distance differed 100 m during 16 h observation time. After smoothing_11 the longest and the shortest distance differed 75 m. After cutting (zone) the longest and the shortest distance differed 87 m. Table 1 shows the distance differences between raw data and corrected data.

Table 1 Description of distance in m moved by the animals (Minimum, Maximum, Mean and Median) for raw and corrected data

	Raw distance	Smooth_5	Smooth_11	Zone
Minimum in m	228.1	229.7	191.0	223.2
Maximum in m	452.3	442.3	342.8	389.9
Mean in m	343.0	342.4	281.1	319.6
Median in m	328.2	330.3	265.8	310.9

Correlations were high in all cases:

1. Correlation of minimum track smoothing (smooth_5)*raw data: 0.98
2. Correlation of medium track smoothing (smooth_11)*raw data: 0.94
3. Correlation of clipping zone (zone)*raw data: 0.96
4. Correlation of clipping zone*minimum track smoothing (zone*smooth_5)*raw data: 0.97
5. Correlation of clipping zone*medium track smoothing (zone*smooth_11)*raw data: 0.95

Conclusion

All data corrections correlated highly with the raw data. It appears that data correction does not lead to different results of high and low active animals. UWB is a practical instrument for activity measurement in poultry e.g., for comparison of the activity of low and high feather pecking lines.

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