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Data Descriptor

Goat Kidding Dataset

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Abstract: The detection of kidding in production animals is of the utmost importance, given the frequency of problems associated with the process, and the fact that timely human help can be a safeguard for the well-being of the mother and kid. The continuous human monitoring of the process is expensive, given the uncertainty of when it will occur, so the establishment of an autonomous mechanism that does so would allow calling the human responsible who could intervene at the opportune moment. The present dataset consists of data from the sensorization of 16 pregnant and two non-pregnant Charnequeira goats, during a period of four weeks, the kidding period. The data include measurements from neck to floor height, measured by ultrasound and accelerometry data measured by an accelerometer existing at the monitoring collar. Data was continuously sampled throughout the experiment every 10 s. The goats were monitored both in the goat shelter (day and night) and during the grazing period in the pasture. The births of the animals were also registered, both in terms of the time at which they took place, but also with details regarding how they took place and the number of offspring, and notes were also added.

Dataset: https://figshare.com/s/925215e8ea73da4b01f2

Dataset License: CC BY 4.0

Keywords: goat kidding; posture monitoring; inertial sensors

Citation: Gonçalves, P.; Marques, M.R.; Belo, A.T.; Monteiro, A.; Braz, F. Goat Kidding Dataset. *Data* **2022**, *7*, 89. https://doi.org/10.3390/data7070089

Academic Editor: Barbara Contiero

Received: 26 May 2022
Accepted: 28 June 2022
Published: 29 June 2022

1. Introduction

Animal monitoring based on ICT technologies is part of the smart-farming trend and has been receiving enormous attention in the last five years, both from academia and the business sector. Electronic monitoring of animals is of enormous importance, as it allows the human operator to be freed from the task and the consequent reduction of inherent costs. In the case of birth monitoring, monitoring also has an additional motivation, given the need to intervene in the birthing process due to the frequent problems associated with births, and to ensure animal welfare.

Sensors have several potential applications in modern livestock farming and are considered one of the most promising techniques in animal monitoring is the use of inertial sensors [1], due to their low cost and their ability to characterize animal behavior. The process consists of the periodic sensing of animal behavior data and the subsequent use of computer learning techniques in order to teach a machine about the desired behavior, so that the machine can later autonomously detect it [2,3].

Accelerometer sensors (neck, leg, and ear tags) have been developed for early detection of diseases or lameness in cattle and thus pain and stress [4,5], to study feed intake and feeding behavior (e.g., rumination time) in cows [2], in sheep [6–9], and in goats [10–12]. Moreover, in dairy cattle accelerometer sensors are used for calving and estrus detection [13].

The present dataset was generated from a set of Charnequeira goats from the INIAV flock, to which iFarmTec (Aveiro, Portugal) [14] collars were applied, before, during and in the postpartum period. Behavior data were sampled every 10 s and recorded on a 24/7 basis. In addition to these data, data about the births were recorded, such as the date/time at which they occurred, the place, the gender of the offspring, the number and the weight of the offspring born, and, additional, details such as the need for human intervention.

These data were collected to enhance knowledge of goat behaviors both indoors and at pasture. Goats were monitored 24/7, thus all types of behaviors have been recorded: from sleeping habits to feeding behavior, from kidding to suckling their kids, passing though social interactions and welfare. The development of an alert system based on this data, has the potential to reduce labor costs and animal mortality and increase goat farms' performance.

The document continues with the characterization of the dataset and description of the data structure in Section 2 and with the description of the notes about deliveries in Section 3. Section 4 describes the data collection methodology and Section 5 concludes the paper.

2. Data Description

2.1. Dataset Summary

The original dataset contains 1,947,349 records collected during the interval between April 2022 and May 2022, considering the two environments (shelter and pasture). Section 2.2 presents the steps to process the original data, including transformation and adjusting of data.

The final dataset, described in Table 1, has 1,565,813 records ordered and summarized by index columns (ID, year, month, day, hour, minute, and second).

Table 1. Final dataset structure.

Attribute	Content
ID	Animal Identification
timestamp	Timestamp of record
year	Year
month	Month
day	Day
hour	Hour
minute	Minute
second	Second
wd	Weekday
env	Environment ('c'—shelter, 'p'—pasture)
Partum	(0—no, 1—single, 2—double, 3—triple ...)
Dist	Neck distance to ground (mm)
Pitch	*Pitch* angle (degrees)
Roll	*Roll* angle (degrees)
Dx	Accelerometer delta in *X* axis
Dy	Accelerometer delta in *Y* axis
Dz	Accelerometer delta in *Z* axis

ID represents the identification of the animal; the *timestamp* stores the instant of the record produced by the collar. *Year, month, day, hour, minute, second,* and *wd* are derived measures computed from the *timestamp* value.

The location where the goats stay when the collar record is produced is stored in the attribute named "env"; the "*p*" value represents pasture, and the shelter by the "c" value. Information about the animal's partum is represented by the attribute "partum": "0" means no kidding, "1" one kid, "2" two kids, and "3" three kids.

The neck distance to the ground is stored in the *Dist* attribute. The attribute *Pitch* holds the measures of the inclination angle related to the horizontal plane, and *Roll* represents the rotation angle.

They were collected 1,201,247 records in the shelter and 364,566 in the pasture. The records produced during kidding events, distributed along the hour dimension, are presented in Figure 1.

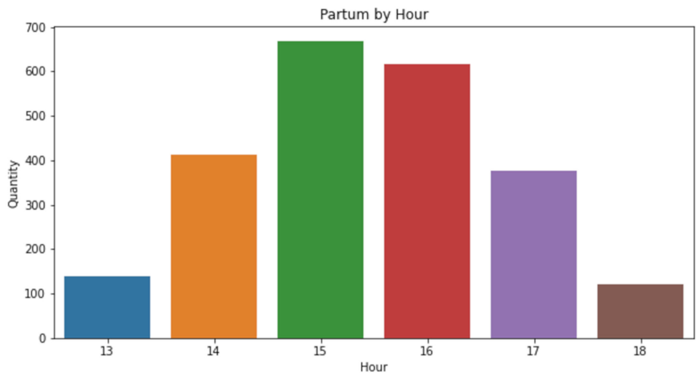

Figure 1. Kidding event hourly distribution.

The attributes correlation is the content of Figure 2. Correlation is a coefficient to represent the strength of a linear association between two variables. A perfect linear relationship is characterized by absolute value 1, and values close to 0 indicate no linear relationship. The data distribution along the hour, considering the combinations among localization (Shelter, Pasture) and kidding (0 or >0), is presented in Figure 3.

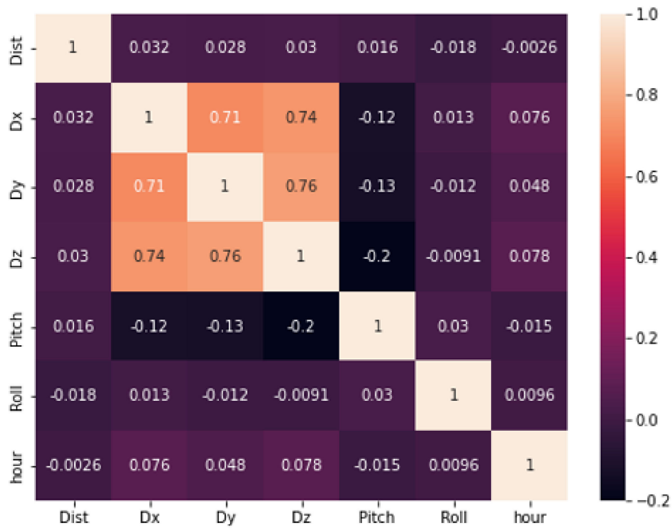

Figure 2. Attributes correlations.

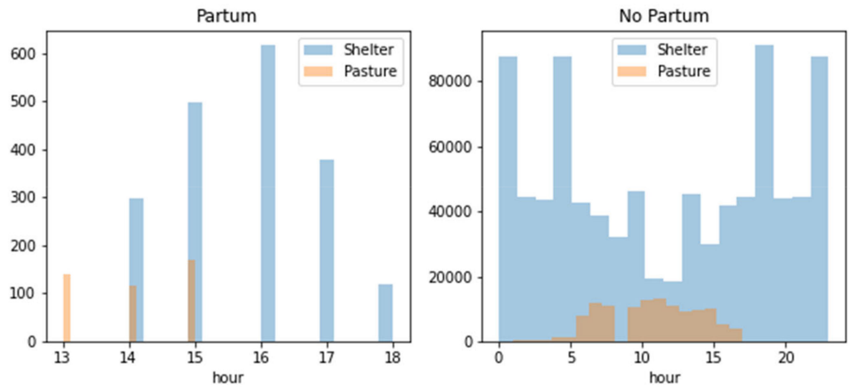

Figure 3. Hourly distribution (Kidding and presence).

The quartiles of *Pitch* and *Roll* attributes are the contents of Figures 4 and 5. For each hour, values of the Mean, Std (Standard Deviation), Min (Minimal), 25% (quartile 1), 50% (quartile 2), 75% (quartile 3), and Max (Maximal) related to values of *Pitch* and *Roll* are presented.

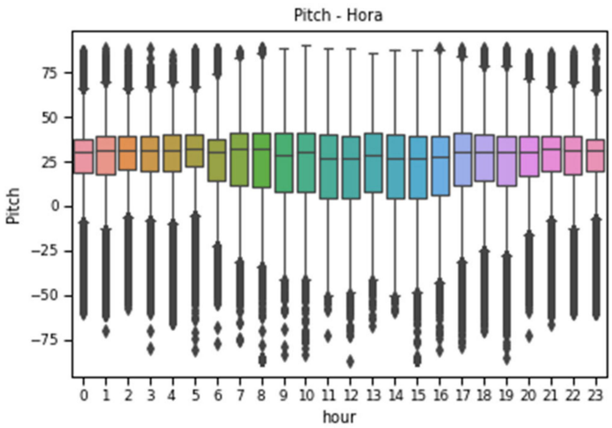

Figure 4. Evolution of *Pitch* angle.

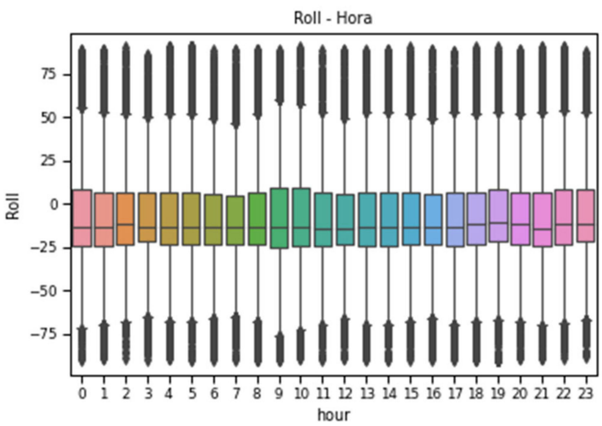

Figure 5. Evolution of *Roll* angle during pasture stay.

Finally, Figures 6 and 7 represent the daily distribution of gathered records. Figure 6 presents pasture values, and the complete dataset is represented by Figure 7.

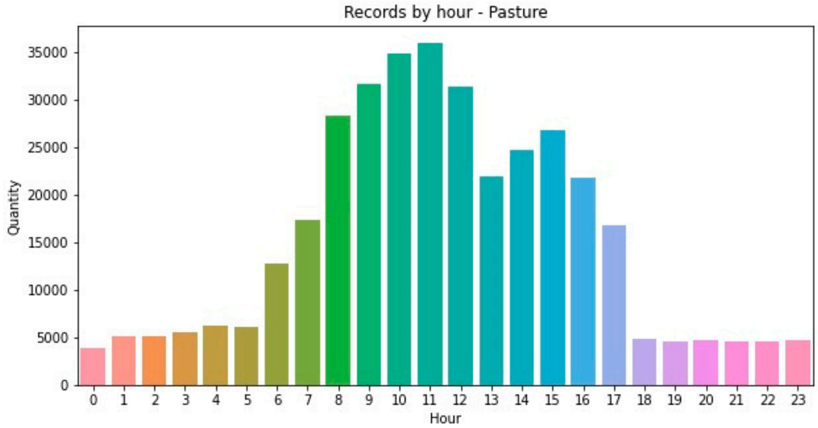

Figure 6. Pasture record distribution.

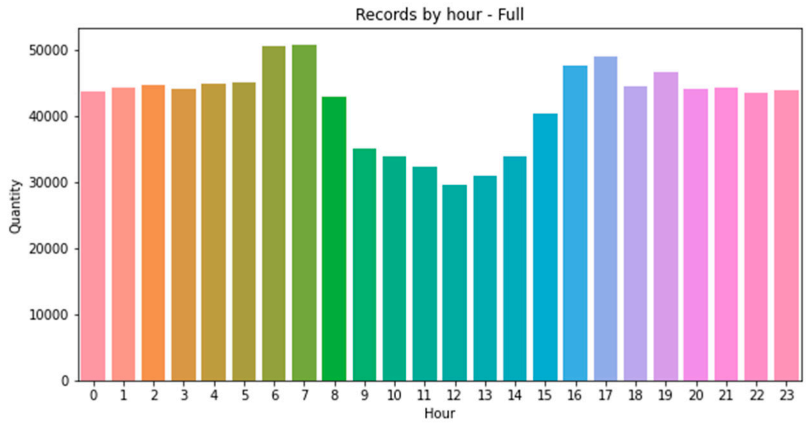

Figure 7. Daily distribution of gathered records.

2.2. Dataset Preparation

Figure 8 shows the complete method designed to prepare the final dataset. The process contains four steps:

(a) concatenation: concatenation of daily files content, from the both gateways
(b) duplicates elimination: elimination of record duplicates and malformed records removal
(c) additional attributes: insertion of additional attributes
(d) partum annotation: record annotation with partum information.

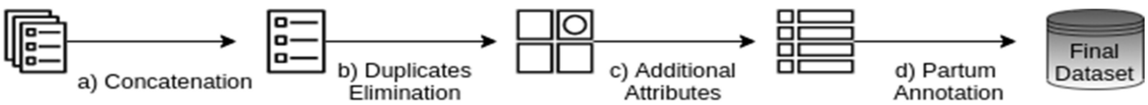

Figure 8. Data processing.

The original dataset is composed of daily files produced by the gateways that continuously store gathered data, one at the shelter, the other at the pasture; Table 2 presents the attributes for each file. Each record is produced at a frequency of 10 s.

Table 2. Daily file attributes.

Attribute	Content
ID	Animal Identification
timestamp	Timestamp of record
Dist	Neck distance to ground (mm)
Pitch	*Pitch* angle (degrees)
Roll	*Roll* angle (degrees)
Dx	Accelerometer delta in *X* axis
Dy	Accelerometer delta in *Y* axis
Dz	Accelerometer delta in *Z* axis

A file contains records of different collars of a day. Therefore, the first step of the process is to concatenate the files to produce a single dataset (a). In the following, the duplicated records are removed from the file (b). Attributes representing *year, month, day, hour, minute, second*, and *weekday* are computed in the next step (c). Also, the attribute *env* is created in this step; the goal is to store the localization of the goat.

Finally, the annotation of the animal's partum happens in the last step (d). The values are recorded in the *Partum* attribute. Table 3 presents some examples of these annotations.

Table 3. Birth detail annotations.

Collar	Date	Hour	Type	Sex	Weigh (Kg)	Local	Observations
C7_07	19 April 2022	14:10	Double	Female	3.300	Shelter	With help
C7_07	19 April 2022	14:30	Double	Female	2.280	Shelter	
C9_77	20 April 2022	14:30	Double	Male	3.200	Pasture	Not sure of the time
C9_77	20 April 2022	14:45	Double	Male	3.260	Pasture	Not sure of the time
C2_44	22 April 2022	15:53	Double	Female	3.040	Shelter	
C2_44	22 April 2022	16:30	Double	Female	3.300	Shelter	
C17_41	23 April 2022	<17:00	Double	Female	3.150	Shelter	Not sure of the time
C17_41	23 April 2022	~17:00	Double	Female	2.950	Shelter	Not sure of the time
C13_78	24 April 2022	~16:00	Simples	Male	3.445	Pasture	Not sure of the time
C14_08	25 April 2022	16:45	Triple	Female	2.100	Shelter	
C14_08	25 April 2022	17:30	Triple	Female	2.495	Shelter	
C14_08	25 April 2022	18:15	Triple	Male	3.300	Shelter	
C8_17	28 April 2022	<14:20	Triple	Female	2.830	Pasture	Not sure of the time
C8_17	28 April 2022	16:15	Triple	Male	3.430	Shelter	With help—ended up dying
C8_17	28 April 2022	16:30	Triple	Female	2.150	Shelter	With help
C18_76	28 April 2022	<14:20	Single	Female	2.930	Pasture	
C6_69	2 April 2022	13:30	Single	Female	3.100	Shelter	
C17_46	3 May 2022	17:53	Double	Male	3.020	Shelter	
C17_46	3 May 2022	17:55	Double	Female	1.495	Shelter	
C15_60	4 May 2022		Double	Female	2.970	Pasture	During the afternoon
C15_60	4 May 2022		Double	Female	3.400	Pasture	During the afternoon
C19_68	5 May 2022		Triple	Male	3.530	Shelter	Without the collar; it was charging
C19_68	5 May 2022		Triple	Female	2.555	Shelter	Without the collar; it was charging
C19_68	5 May 2022		Triple	Female	1.820	Shelter	Without the collar; it was charging
C1_74	12 May 2022	9:30	Single	Male	3.555	Pasture	
C5_47	12 May 2022	13:20	Single	Female	2.150	Shelter	With help—ended up dying two days later
C20_93	12 May 2022	14:45	Single	Female	3.285	Shelter	With help
C10_40	12 May 2022	22:40	Double	Female	3.620	Shelter	
C10_40	12 May 2022	22:55	Double	Male	3.985	Shelter	With a little help

3. Kidding Annotations

In addition to being monitored by the collar, the births were visually monitored, and the details related to the process were recorded, such as the date and time, the gender, the type of partum (single, double, or triple), the kid's weight and the place where it took place, as well as a set of separate notes. The annotations were verified by INIAV staff and transcribed to Table 3.

A brief note should be given regarding collar 17 which was migrated from an animal (goat 41) to another animal (goat 46), after the first goat had suffered a leg injury and was thereby immobilized. The transfer was carried out on day 28 May 2022 and the collar accompanied the goat when giving birth to its two kids.

An additional note should be added that has to do with the typical behavior of mammals after kidding. They caress their cubs, licking them, as illustrated in the photograph in the Figure 9.

Figure 9. Detail of a goat licking its kid after giving birth.

4. Data Gathering Methods

Data were captured over four weeks using iFarmTec [14] collars on 16 pregnant Charnequeira goats, encompassing the animals' kidding time. Data from two control non-pregnant goats were also collected. The collars were integrated into the monitoring platform, illustrated in Figure 10, making periodic communications whose data were stored in the gateway [15]. Collars include an ultrasound sensor that measures the neck distance to the ground, an accelerometer and a magnetometer [3] and have been parameterized to sample data every 10 s and to forward the gathered data to the infrastructure.

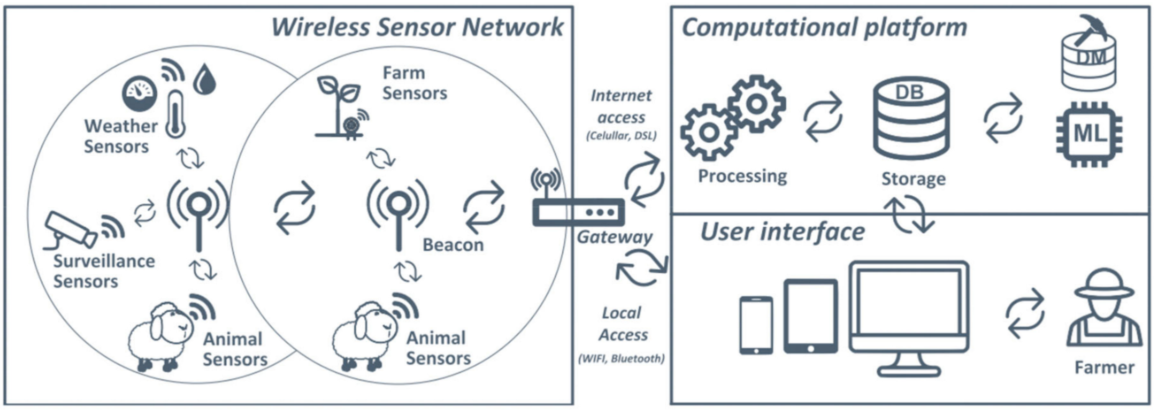

Figure 10. Collar integration in the monitoring platform.

The experience started at 13 April and lasted until 16 May 2022, and collars were kept on the goat's neck throughout the period. The wireless sensor network deployed had two gateways simultaneously connected, so animal collar communications were received both when they were in the shelter and at the pasture. A single beacon was attached to each gateway, limiting radio coverage with the collars, which meant that some messages sent periodically were not received. Given the extension of the meadow where the animals grazed (Figure 11), there were some communication failures, as can be seen in the volume of records from the pasture set.

Figure 11. Animals on pasture.

The animals' routine remained unchanged during the time of the experiment, spending part of the daytime period in the pasture (Figures 11 and 12), and the nighttime period inside the shelter.

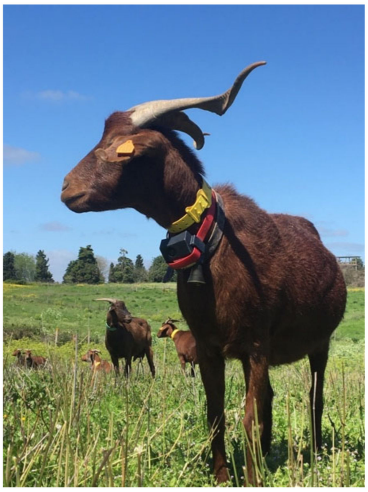

Figure 12. Goat wearing a sensoring collar to monitor grazing behavior in pasture.

5. Conclusions

Present dataset was created based on data gathered by iFarmTec collars, applied to 16 pregnant and two non-pregnant goats for control purposes. The tests were carried out between 13 April and 16 May 2022, at the INIAV facilities at Quinta da Boa Fonte in Vale de Santarem. Animals kept their collars in a 24/7 period and the data was collected by a pair of gateways, one present at the shelter, the other at the pasture.

The dataset includes 1,565,813 records, and it covers the period the goats kidded, some in the shelter and other on the pasture. Additionally, present paper includes annotations taken during human supervision of kidding process adding some details to the dataset information.

Author Contributions: Conceptualization, P.G., M.R.M., A.T.B. and A.M.; methodology P.G., M.R.M., A.T.B., A.M. and F.B.; software, F.B.; validation, P.G., M.R.M., A.T.B., A.M. and F.B.; formal analysis F.B.; investigation, P.G., M.R.M., A.T.B. and F.B.; resources, P.G., M.R.M. and A.T.B.; data curation, P.G. and F.B.; writing—original draft preparation, P.G., M.R.M., A.T.B., A.M. and F.B.; writing—review and editing, P.G., M.R.M., A.T.B., A.M. and F.B.; visualization, P.G., M.R.M., A.T.B., A.M. and F.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by European Fund for Regional Development (ERDF), project VegMedCabras—ALT20-03-0145-FEDER-000009, and by FCT/MCTES through national funds and when applicable co-funded EU funds under the project UIDB/50008/2020-UIDP/50008/2020.

Institutional Review Board Statement: Ethical review and approval were waived for this study due to REASON that the system does not interfere with animals.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data available at https://figshare.com/s/925215e8ea73da4b01f2, 25 May 2022.

Acknowledgments: The authors take the opportunity to thank José Pereira from iFramTec for the support in the maintenance of the collars.

Conflicts of Interest: The authors declare no conflict of interest.

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