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A Monitoring Device for Studying Feed, Water Intake and Excretion of Individual Poultry

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Abstract: A monitoring device for individual poultry production performance parameters was designed based on information technology. Production performance parameters like food intake, excretion, water intake, egg weight, laying time can be recorded by sensors. The modern industrial design ideas were applied in the design of its structure and appearance. The results showed: The feed intake relative error was 0.035%.It provides a new study instrument for workers in breeding, feedstuff, nutrition and the like.

Key words: Monitoring device, feed intake, water intake, excretion

INTRODUCTION

Poultry individual production performance parameters are so far recorded manually by scientists in terms of breeding, feed stuffs and nutrition. It is time-consuming and labor intensive, such as the need for consecutively 24 h of monitoring. Besides, data acquired manually are too subjectivewhich is not good for accurate, stable and continuous recording. What's more important, some parameters are not easily tested. Frequent manual operation can cause serious stress to poultry and thus poultry production performance is affected.

With the rapid development of informatization, computer network acquisition and abundant data processing in the scientific research and production have gradually been applied in the work of poultry breeding technology in many developed countries (Lu *et al*., 2003). Computer-assisted information collection and processing technology has become the powerful auxiliary force to scientific research. For instance, America mainly takes advantage of large automatic feed processing and large-scale raising machinerywhich gives into full play its high technology scale benefit (Ni *et al*., 2009).

Under the guidance of "people-oriented" humanized design concept of industrial design, the monitoring device uses automated information collection and processing method, avoiding a lot of troublesome manual work. The results would be avoided being influenced by the manual operation of breeding poultry from human factors. It can also dynamically show poultry production performance and the environmental state and that just in the laboratory. It is possible to keep observing poultry in succession, realizing the overall information management of culture process. The working principle of the device is shown in Fig. 1.

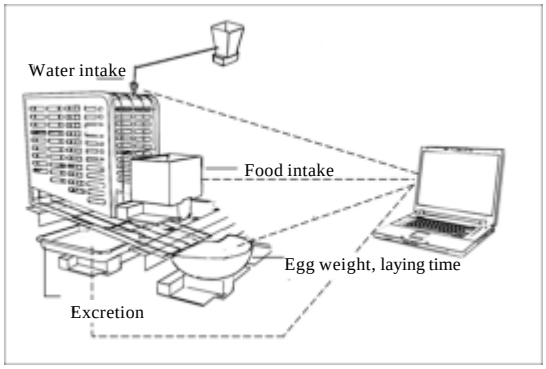

Fig. 1: Schematic diagram of the monitoring device

DESIGN OF THE MORINITORING DEVICE

The monitoring device records data with various Atmega16 chips as its assistant nodes (Carey, 1987). Itcommunicates information to the center nodes in the way of RS-485 and transfers the data to computer in real time. So the real-time monitoring of performance of poultry, such as weight, feeding, drinking, excretion, the times of excretion, the lay eggs time and the weight of egg, is becoming reality.

The main body of such a monitoring device is divided into poultry cage and data information collection framewhich are available for the combined use. Or the poultry cage can be used alone in daily feeding. When it is necessary to collect individual information, you can just embed it into the cage and then make adjustments to hold it in position, as shown in Fig. 2 and 3.

The design of poultry cage: The cage let the poultry in the single cage alone for the need of data acquisition of single

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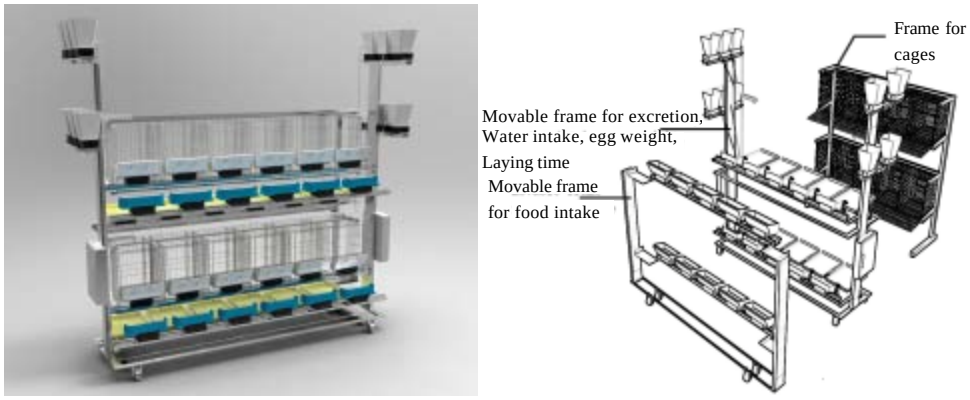

Fig. 2: Use of the monitoring device

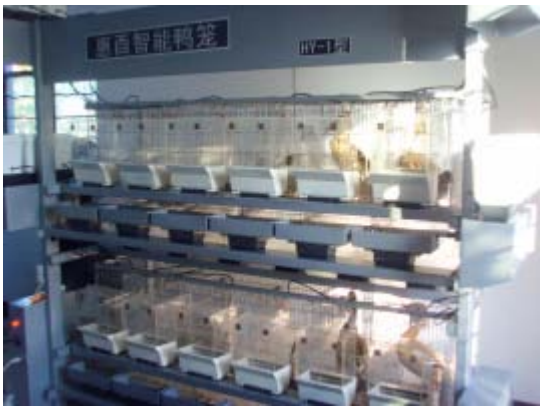

Fig. 3: The monitoring device in lab

poultry. Each cage is 250 mm long and 360 mm wide. The front is 375 mm high; the back is 340 mm high. The cage simulates the space of one single hen takes up when living in colonies and also meets the need of animal welfare. The design of "one poultry in the single cage alone" is convenient for collecting the data of a single poultry. Space between each cage is 50 mm which can prevent two neighboring poultry from fighting against each other. On the other hand, it can avoid exerting a mutual influence on testing devices for insufficient space between themwhich may lead to data collection error.

The frame used for data collection: It has five parts including data acquisition modules for feeding weight, drinking weight, the dung heavy, the egg weight and lay eggs time.The five modules can be customized and used according to specific needs of research condition.

Data acquisition module for feeding weight: It consists of an independent feed box and a weight sensor.

Data acquisition module for dung weight: It consists of a dung plate and a weight sensor. The size of the dung plate's underside is 300×400 mm, slightly larger than the cage. It allows for collecting manure to the hilt and helps reduce errors of data acquisition.

Data acquisition module for drinking: It consists of a square container connected with drinking fountains and a weight sensor. The drinker is fitted in the beam above cageswhich reduces the influence on the weight sensor when poultry are drinking. Data acquisition module for Egg weight: It contains an egg receiver and a weight sensor as well. In the inner bottom is placed rubber cushion to in case of eggshells being damaged.

Data acquisition module for lay eggs time: The module consists of a sensor and the supporter.

TEST

We made experiments with 10 layers as one team in 1 week.

Feed intake check: automatic acquisition system statistics each laying hens feed intake of a day, electronic balance to measure the current weight as to analyze errors for the improvement of the device in the future. Table 1 shows the comparisons of the average feed intake amount of the ten layers. The results show that the feed intake measured errors are less than 0.035%.

Egg production time record: Validated with video monitoring system of egg production time record

Table 1: Comparison of food

Laying number	Manual measurements (g)	Measurements by data collection system (g)	Deviation (g)
1	147	146	1
2	127	126	1
3	112	112	0
4	132	130	2
5	131	130	1
6	120	122	2
7	103	102	1
8	115	115	0
9	127	125	2
10	121	123	2

The average error is 0.32 %

Table 2: Laying time contrast table

Laying number	Record time of egg production systems	The video monitoring record egg production time
1	2010-11-1 8:44	2010-11-1 8:44
2	2010-11-1 8:19	2010-11-1 8:19
3	2010-11-18:29	2010-11-18:29
4	2010-11-1 11:49	2010-11-1 11:49
5	2010-11-1 8:58	2010-11-1 8:58
6	0	2010-11-2 15:44
7	2010-11-2 15:44	2010-11-2 15:44
8	2010-11-1 9:13	2010-11-1 9:13
9	2010-11-1 11:18	2010-11-1 11:18
10	2010-11-1 16:34	2010-11-1 16:34

accuracy, Table 2 was system automatically record egg production time and video monitoring record egg production results. The NO.6hen's egg had been blocked by cage,so the device cann't record it's information about laying time.

CONCLUSIONS

In conclusion, it is possible to automatically register when, what and how much each hen eats by using this type of system.The collected data can be correlated to the performance of egg-laying hens. Compared with manual operation, the device has many advantages such as the huge amount, less stree, high speed acquisition and being natural. Meanwhile, it greatly reduces users' workloadwhich is the embodiment of the humanization design ideas.

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