Study on duck weight estimation by using image processing

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Abstract. The objective of this research was to process digital image to investigate the possibility of ducks weight estimation based on the software LabVIEW with the vision builder. In this study the images were record by the top-view camera. An ellipse fitting algorithm was applied to localize ducks within the stall. Estimating duck weight consists of these steps. First, image acquisition. Second, counts pixel of the samples. Third calculate duck weight by using samples pixel as the output. Results from this study showed that, the estimated ducks weight by using digital photos had 3.27% of the error when compare to the measured weight. The correlation coefficient of the body weight prediction equation from a comparison between measured (absolute) and estimated by camera for all duck is clearly high (R^2=0.91). It was found that the system able to estimate duck weight with an acceptable error. So we can develop this research processing or build up the automatic sorting duck in the future. This method operated pretty well in prophecy live weight.

1 Introduction

Nowadays, over 72 billion land animals are slaughtered every year around the world for food production [1]. The increasing demand of animal products fosters intensive animal husbandry. Market demands force producers to increase the number of animals in their flock or herd with fewer available resources (per animal). Responding the demands of the market while providing enough care to the individual animals, farmers might use automatic tools to monitor welfare and health of their animals [2]. While existing systems facilitate an efficient use of land and labour, the increased number of animals per farm has resulted in new welfare problems because time is too limited to provide individual animal care [3].

Duck's meat as a food source has always been used in high demand. The main factor which affects the proportion of meat of a duck is the weight of duck. Thus it becomes a major factor for selecting the duck. Presently in Thailand farming duck has become an important meat industry in the country. Both fresh and cooked duck products are sold whole, not dissected like other meats. In a big farm, raising duck are over ten thousand ducks per house, which ducks have to weigh every week to monitor their growth. At present, the ducks are weighed by two people or more than this to hold the ducks and weigh

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them one by one, thus it taking long time in the operation. This method ducks were disturbed by having to be weighed, causing stress, resulting in reduced food intake, slowed growth, inconvenient in working and takes much time. In addition, the resulting weight is not accurate, it cannot be used as a representative of the whole duck weight, as the random weighing cannot be carried out in the whole pen, with only a portion of 100 or less because ducks will be shocked, run and step on each other. Estimating weight of the duck through naked eye is not possible for naive consumers because they are not used to such techniques so the producers guess the weight of the duck by looking at it. Sometimes duck weighing is done through weighing scales by placing the duck on weighing scales one by one which is a very tedious task. So there needs to be a better and optimal way of measuring the duck weight through modern technique.

The weight of an animal can also be estimated based on the animal's body measurements as measured directly from the body of the animal using a flexible measuring tape called a tailors rule. In this weight estimation process a stockperson uses the animal's body measurements as variable inputs into a weight-estimation equation. Live weight of an animal is an essential reference in various studies, such as animal growth, feed conversion, health condition and disease occurrence [4]. The weight of growing animals provides a valuable parameter or indicator for keeping them at suitable level of nutrition and environment [4]. The profit from the animal is usually closely related to the balance between incomes and costs [5], which depends on the size and weight of the production. Nowadays, the development of technology and digital imaging system allows an indirect way to measure live animal weight from its body feature by image analysis method. White et al. (2004) used visual image analysis system for monitoring size and shape of pigs to control live body weight as an efficient way. Body measurements suggested for estimating live body weight are simple and easily measured [6]. There are many techniques available to do and also feasible techniques [7].

Therefore, the main purpose of this research is to develop an efficient algorithm for volume determination of ducks base on LabVIEW with the vision builder software. This measurement technique presents much qualification, such as non-contact, fast and labour saving.

2 Materials and methods

2.1 Experimental station

An image can contain a lot of meanings. This is a basic feature of an object in the picture. So, there is a way to put out each basic feature to apply for working. This research used the techniques of image processing which focused on the process and method to distinguish the basic features of duck photo to analyze duck weight. This experiment was practiced in a commercial smart farm in the agricultural centre (KS Farm) at Ongkharak district, Nakhonnayuk Province, Thailand (14°04'21.0"N 101°04'30.0"E). The images were obtained by the image acquisition system using LabVIEW 2019 with the vision builder. Ten ducks with 50 days old (mixed sexes) with the weight of 2,700 – 3,500 g kept in the small pen-sized 1m x1m (10 birds/ m^2) were used in this experiment.

2.2 Experimental design

The duck images were captured by using a SONY digital camera (IMX179 CS Mount 4 mm manual focus lens industrial high resolution 8MP usb camera (Figure. 1), and image format was JPEG. An assistant device was set up to support the camera, which consisted of

a 2.0 m height vertical stand and a horizontal arm mounted at 90° from the top of the upright position as shown in figure1 [8]. The box used for the image analysis had a dark floor to provide a high contrast between duck and background, measuring 100 cm x 50 cm. Images were conducted at night-time as shown in figure2.

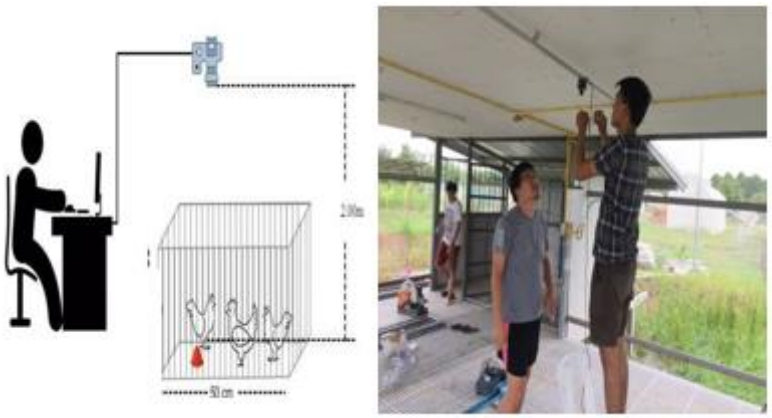

Fig. 1. Installation system of the experiment.

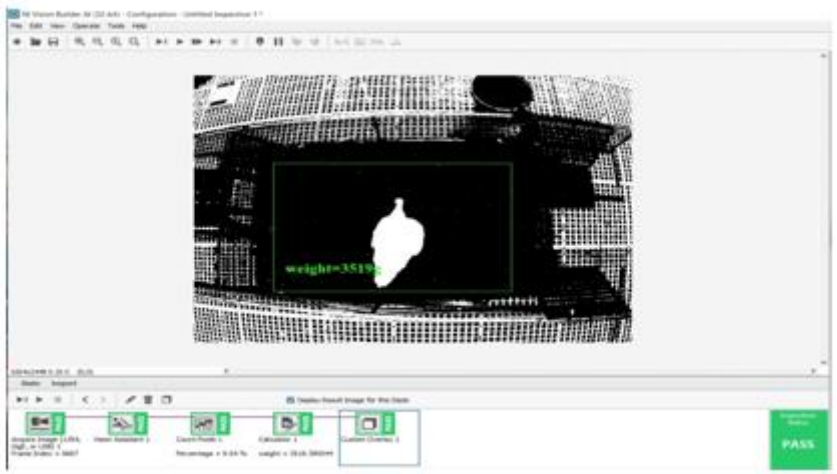

Fig. 2. Estimated weight by programed and real weight by digital scale.

3 Results and discussion

The experiment used all sizes of 10 ducks. The exactitude of duck weight prediction was estimated from a comparison between absolute and predicted weights over all ducks averages with R^2=0.91. Results are graphically shown in Figure 4 and duck weights are shown in Table1.

Table 1. Duck weight from programed with digital scale.

Duck sample	Weight (g)			% error
	From programed	From Digital Scale	Different weight	
D1	2762	2733	29	1.06
D2	3723	3623	100	2.76
D3	3411	3302	109	3.30
D4	3256	3145	111	3.53
D5	3317	3253	64	1.97
D6	3067	2899	168	5.80
D7	2931	2789	142	5.09
D8	3426	3301	125	3.79
D9	3134	3061	73	2.38
D10	3523	3413	110	3.22
Average	3255	3151.9	103.1	3.27

Fig. 3. Estimated weight by programed and real weight by digital scale.

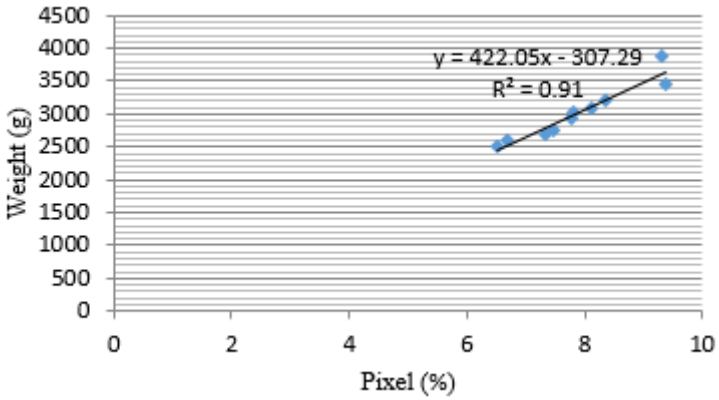

Fig. 4. Relationship between weight and pixel.

Table.1 displays the duck weight from digital image processing. According to the research methodology discussed initially and shows the size of each duck following the agricultural commodity and food standard. The result of weight analysis has a few different from digital scale. For example the first sample of duck D1 has a result from analysis pregame is 2,762 g but measure by digital scale is 2,733 g so the different weight is 29 g and the percentage of error is 1.06 %. Next is the sixth sample of duck D6 has a result from analysis programed is 3,067 g but from digital scale is 2,899 g so the different weight is 168 g and the percentage of error is 5.80%. The average of all ten duck samples in analysis is 3,151.9 g measured by programed and by digital scale is 3,255 g the different weigh is 103.1 g and the percentage of error is 3.27%.

4 Conclusions

According to the results found that the analysis of duck weight by using image processing which selected the specific area of the object by focusing on the edges of the object then considering basis attribute of the object such as the width, the length to calculate to find the real weight with the percentage error is only 3.27%. This research methodology can be applied to create the automatic sorting duck machine to use in big, medium, and small sizes industries. The LabVIEW with vision builder had strong robustness and powerful processing data function.

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