Meat Identifier for Beef and Boar Based on Digital Image Processing

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***Abstract*—This article describes the design results of meat type identification tool with digital image processing based on raspberry pi 3 which can work automatically. In this study, beef and pheasant meat are used. This research starts from designing system model, hardware design, software design, and testing. This tool uses Raspberry Pi 3 as a brain that does the process of identifying using python 2.7 and OpenCV as the software. Raspberry Pi Camera Module V2 is used to take pictures of meat objects that will be identified. The process of digital image processing is then done on the image of the meat object, that is, the cropping process and the extraction process of RGB value from the meat image. Furthermore the software will perform the calculation of the percentage of RGB image components and then compared with the percentage of RBG component components of the sampled meat data types and will result in identification of the type of meat being tested. The process undertaken before the tool can identify the type of meat is sampling data to obtain the parameter values that can be used to identify the type of meat. Sampling data were conducted using image data of several types of meat, namely beef, and wild boar meat, with sample data of each type of meat is 10 images. This type of meat identification tool can identify the type of beef and wild boar meat with a success rate of 80%.**

Keywords— ***meat identifier, image processing, image characterization, automatically***

I. INTRODUCTION (*HEADING 1*)

Identification of types of meat is still done manually in the community. To distinguish the characteristics of meat by type is done by observing the color, texture elasticity, texture fibers, and also the smell or aroma. With the automation technology, the identification of these types of meat can be done automatically to facilitate human work. By using Python 2.7 and Open CV for image processing as well as microprocessors on Raspberry Pi 3, the meat identification process can be done well and also automatically. The workings of this type of meat identification tool is to take a snapshot of the meat using Raspberry Pi Camera Module, then the results will be processed using Python 2.7 and Open CV programming with extract methods RGB value (Red, Green, Blue) imaging at the Raspberry Pi 3. Results the image processing will be compared with the results of RGB image extraction on samples of several types of meat that already exist in the memory used as comparative data so that the meat can be identified as a certain type of animal meat. Previous research under the title "Classification of Meat Type Consumption Based on Texture Analysis With Image Processing" [1], and "Separate Color Intensity to Identify Lamb, Pork, Boar Meat, and Dog Meat" [2]. Differences with this research with existing research that is on image processing methods and software used and the end result of research conducted. In the previous research the final result of his research was the application program to classify the type of meat, while in this research the final result was the design identifier to identify the type of meat automatically.

II. LITERATURE REVIEW

A. *Meat*

Meat is one of the livestock products consumed to meet the nutritional needs such as protein, this is because the meat contains proteins that also contain essential amino acids in it. Meat is defined as part of the beast used by humans as a foodstuff, besides having an appealing appearance, is also a source of high-quality animal protein [2].

The characteristics of various types of meat consumption as follows [3]:

a. Beef, pale red, purplish or brownish can turn into cherry color when meat is exposed to oxygen. However, when it is exposed to air for too long the color will turn into brown. It has fine fibers but is not easily crushed and there is little yellow fat.

b. Boar or wild boar meat, has a coarser texture and a darker color than pork so it's a bit like beef.

B. *Digital Image Processing*

According [4] in his research journals, digital image processing (Digital Image Processing) is a discipline that studies the techniques of image processing. The image in question here is a still image (pictured) as well as a moving image (which comes from a webcam). While digital here has the intention that the image processing/image is done digitally using a computer.

A digital image is represented by a two dimensional matrix f (x, y) consisting of M columns and N lines, where intersections between columns and rows are called pixels (picture element) or the smallest element of an image (eq. 1).

$$f(x,y) \approx \begin{bmatrix} f(0,0) & f(0,1) & \cdots & f(0,M-1) \\ f(1,0) & f(1,1) & \cdots & f(1,M-1) \\ \vdots & \vdots & \vdots & \vdots \\ f(N-1,0) & f(N-1,1) & \cdots & f(N-1,M-1) \end{bmatrix} \quad (1)$$

An image f (x, y) in a mathematical function can be written as follows:

$0 \le x \le M-1$
$0 \le y \le N-1$
$0 \le f(x,y) \le G-1$

Where:
M is the number of row pixels in the image array
N is the number of column pixels in the image array
G is grayscale level

The magnitude of M, N, and G are generally the powers of the two.

$$M = 2^m ; N = 2^n ; G = 2^k \quad (2)$$

where the values m, n, and k are positive integers. The interval (0, G) is called the grayscale scale. Big G depends on its process of digitization. Usually the gray 0 (zero) states the black intensity and 1 (one) denotes the white intensity. For an 8 bit image, the value of G equals 2 ^ 8 = 256 colors (gray degree).

C. *RGB Color Features*

RGB stands for Red-Green-Blue, which is the three basic colors used as the universal color reference (primary colors). From the RGB base, we can change the color into the numeric codes so that the color will appear universal. The conversion is done so that digital image data can be further processed. Each digital image has different values. Furthermore, the converted data is extracted according to its RGB value feature [5]. This color image consists of three matrices representing red, green, and blue values for each pixel, such as shown in Fig. 1.

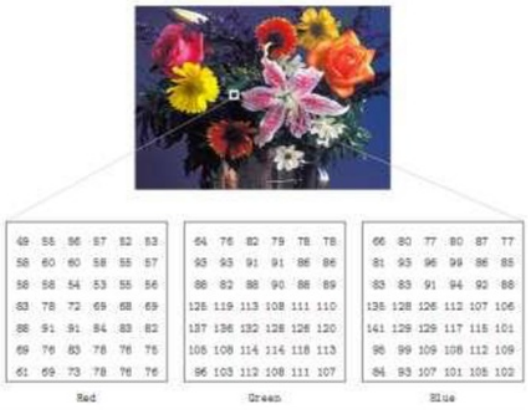

Fig. 1. Color Image

III. Research Method

Research methods include determination tool specifications, system specifications, system model design, hardware design, software design, and testing system.

A. *Tool Spesification*

The tool specifications are as follows:

1. This tool uses PLN power supply that converted to DC 5V/3A using adapter.
2. This tool uses Raspberry Pi Camera Module V2 with 5 MP resolution to take pictures of meat. This camera is used because it matches the Raspberry Pi used and supports the output data in RAW RGB format.
3. Raspberry Pi 3 Model B used has a Broadcom BCM2387 1.2 GHz Quad-Core 64bit processor and 1 G RAM. With this specification, Raspberry Pi 3 can process images quickly.
4. Osoyoo 3.5 "LCD Touchscreen is used as a device to provide shooting commands and also to display the identification results from image processing. The choice of LCD is because it is suitable LCD used with Raspberry Pi 3.
5. Micro SD 16 GB is used as internal storage of Raspberry Pi 3 for both operating system and image data storage.
6. 1W Cool White Lamp is used for illumination when shooting meat. With a constant meat position and optimal lighting, the resulting image can be processed properly.
7. This tool uses Python 2.7 software and OpenCV libraries suitable for image processing.
8. The output of this tool in the form of display from the identification of meat that is the description of the type of meat.

B. *System Specifications:*

The system specifications are as follows:

1. Capable of taking pictures of meat objects in accordance with the wishes of using the LCD Touchscreen to provide shooting commands.
2. Be able to identify the type of meat automatically and display the results in quick time because it uses Raspberry Pi 3 which has a Quad-Core 1.2 GHz processor speed. Image processing done by Python 2.7 which uses memory is small enough and supported by OpenCV library which complete enough for image processing process make identification process faster.

This system while only able to identify two types of meat, namely beef and bacon meat, so that for other types not yet identified.

C. *System Model Design*

Overall the system can be seen in Fig. 2.:

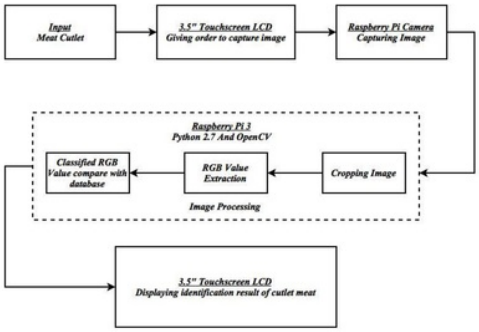

Fig. 2. Diagram Block Overall System

From the block diagram it is seen that the input image will be obtained when Pi Camera take picture of meat object after got command from LCD Touchscreen, then on image will be done image processing process on Raspberry Pi 3 using programming Python 2.7 and OpenCV, and result of result of identification from picture input the meat object displayed by the LCD.

D. Hardware Design

In the design of this system, the hardware used is Raspberry Pi3, Raspberry Pi Camera Module V2, Osoyoo 3.5 "LCD Touchscreen, adapter, and LED 1W Cool White Lamp. In general, the design of hardware on this Research is as follows (Fig. 3):

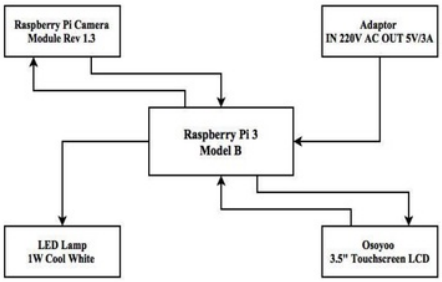

Fig. 3. Block Diagram of Hardware Design

The hardware design model in this research, can be explained in the Fig. 4

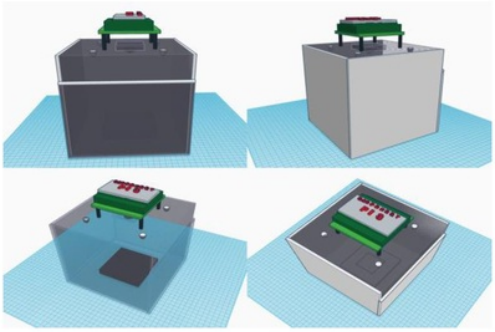

Fig. 4. Hardware Design Model

E. Software Design

The software used in this meat type identification tool is Python 2.7 and OpenCV 2.4.13. Programming in this software will make the modules on the system work and image processing until the identification process goes well. In Python 2.7 run the program to make the modules that are connected to Raspberry Pi 3 can run according to the expected procedure. With the using combination of Python 2.7 programming and OpenCV 2.4.13 library, the meat type identification process will work properly.

IV. Result and Discussion

Sampling data were conducted using image data of several types of meat, namely beef, and wild boar meat, with sample data of each type of meat is 10 images. The process of obtaining parameter values in this sample data is similar to the process of digital image processing in the process of identification of the meat type.

The design of the Meat Type Identification Tool uses Raspberry Pi 3 in which Jettie Raspbian operating system is installed. Raspbian Jessie this is a special operating system raspberry pi based linux. Image processing identified the type of meat in this tool using Python 2.7 program and also OpenCV. Image processing is done to identify this type of meat is cropping process, RGB component value extraction process, and decision-making process obtained from comparison of percentage value of RGB component with sample data. Fig. 5 explains meat identifier.

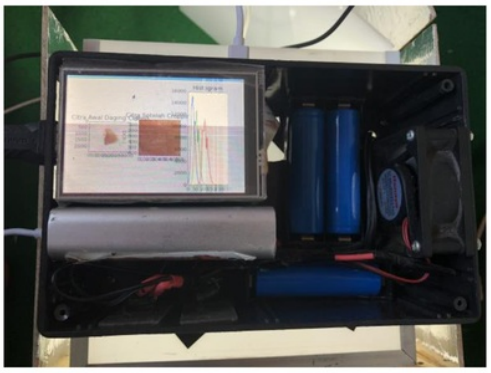

Fig. 5. Display Image Processing on Raspberry Pi screen

Results of Meat Identifier using Digital Image Processing. Having obtained the image of meat samples, the next process is the process of image processing to get the value of RGB color components of each image. The process for obtaining RGB component values consists of two steps:

1. Image cropping process,
2. The process of extracting the average value of the RGB component Image cropping process is done to get the desired image area to get the average value of RGB color component. The cropping process is done by using the cursor to determine the area to be cropped in the form of a rectangle in the image of the meat. After the image cropping process is done, the next process is to determine the average value of the RGB color component of the cropping image. This process is done by extracting the color values of R, G, and B of each pixel in the cropping image, then calculating the average value of each component of the images R, G, and B for all pixels. Here is an example of image processing for each type of meat: beef or wild boar meat.
3. The result of the experiment shows the percentage value of R, G, and B color components for each meat. The percentage value of Red (R) color component for wild boar meat is 45,48%--49,23 %, and for beef meat is 44,88%--46,43%. The percentage of Green color component (G) for wild boar meat is 24.89%--26.29%, and for beef meat is 26.35%--26.82%. The percentage of Blue (B) color component for Pig meat is 27.18%--28.19%, for wild boar meat is 25.85%--28.26%, and for beef meat is 27.12% - 28.40%.

V. Conclusion and Suggestion

A. Conclusion

Based on the analysis and discussion can be concluded that:

1. It has been realized the design of meat identifier with digital image processing based on raspberry pi 3 which can work automatically to identify beef, and wild boar meat.
2. This type of meat identifier can identify the type of beef and wild boar meat with a success rate of 80%.

We suggest that you use a text box to insert a graphic (which is ideally a 300 dpi TIFF or EPS file, with all fonts embedded) because, in an MSW document, this method is somewhat more stable than directly inserting a picture.

To have non-visible rules on your frame, use the MSWord "Format" pull-down menu, select Text Box > Colors and Lines to choose No Fill and No Line.

B. Suggestion

For further research, the authors have suggestions for improvement/improvement that is:

1. Added method of identification of meat types such as texture-based detection methods to obtain more accurate results.
2. Using more sample data to make comparable data on the database more accurate.
3. This tool can be developed into a mobile application for easier use in such as android / IOS based.

Acknowledgment *(Heading 5)*

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