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Design and Implement of an Image Information Identify System

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Abstract: It introduces the hardware design and implement of the image information identify system based on the fluorescent magnetic particle nondestructive detection system of Cannonball. The image information collection system includes Open collecting card model, Initialize collection card model, Apply for EMS memory model, Collecting image model, Write bitmap information head model, Show pictures mode, Close collection card model. Through collecting image information to the EMS memory and then processing the image information, the magnetic images on the cannonball are showed clearly on computer and cracks on the cannonball can easily to be judged. The productivity is improved. The software of the image information collection system is developed by Visual C++.

Key words: Image information identify, hardware design and implement, fluorescence magnetic powder, visual C++

INTRODUCTION

As a way of no damage examination, fluorescence magnetism powder exploring wound is widely used in the world at present. It plays an important role in quality controlling. (Zhang and Yi, 2006; Zhan and Huo, 2009; Zhang *et al*., 2009)

Cannonball is something for the war industry. The quality of the Cannonball is directly related with the safe of the people who operating it and other aspects. As the most important part of war industry, cracks and other bugs are always found on cannonball during check up, so some kinds of casualties such as exploded chamber would be happened during launch. And then people would be hurt and property lost. Although pipelining exploring of cannonball for war industry department has come true it is still need workers to explore the blemish magnetism trace, so workers feel very tired. And fluorescence only can be seen in darkroom, the working condition is very bad, so failing to report the crack and miscarriage of justice are easy occur it is harmful for the safe of cannonball. So it is urgent to develop a computer aid identify wound system to solve these problems.

In this study it introduces the design and development of an image information identify system based on fluorescence magnetism powder exploring wound with no damage for cannonball. It is developed by Visual C++.

INTRODUCTION OF THE FLUORESCENT MAGNETIC POWDER NONDESTRUCTIVE DETECTION SYSTEM OF CANNONBALL

The relationship between the image collection system and the image information identify system is as the following Fig. 1. It includes eight parts such as submit material, pour magnetic liquid, magnetization, Space station, CCD detect, Space station, image processing, demagnetization and withdraw material. In this study our focus is mainly on the image information collecting part. The image processing part includes image collecting, image processing, image measuring and image saving.

THE HARDWARE DESIGN AND IMPLEMENT OF THE IMAGE COLLECTION PART

The system uses fluorescent magnetic particle detection technology. It uses the character of Fluorescent, so it must be in darkroom when we use CCD camera to collect image information. The hardware of the system is as Fig. 2.

Choice of the camera filter: The fluorescent magnetic particle will sent green light when it is inspired by ultraviolet rays but the surface of the workpiece can also reflex different frequency light. Thus, we must put a green-yellow filter before the camera so that the light of the fluorescent magnetic particle (the wavelength is 510~550 nm) can pass it and more visible light can be strained off. Then the background of the workpiece becomes more darkly to ensure the quality of the image.

Place of the CCD camera: The detecting cannonball sample quotas are L is 540 mm and Φ is 130 mm. The cone-shape of the warhead is about one half of the whole length of the cannonball.

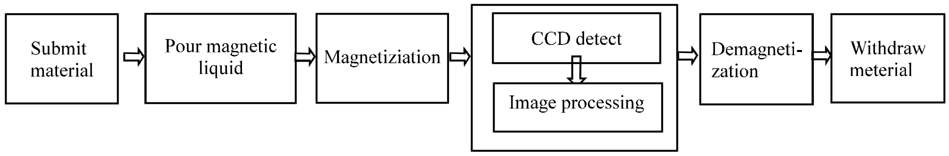

Fig. 1: Working flow

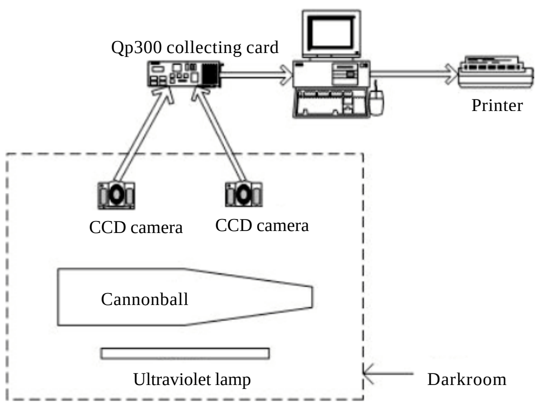

Fig. 2: Hardware of the system

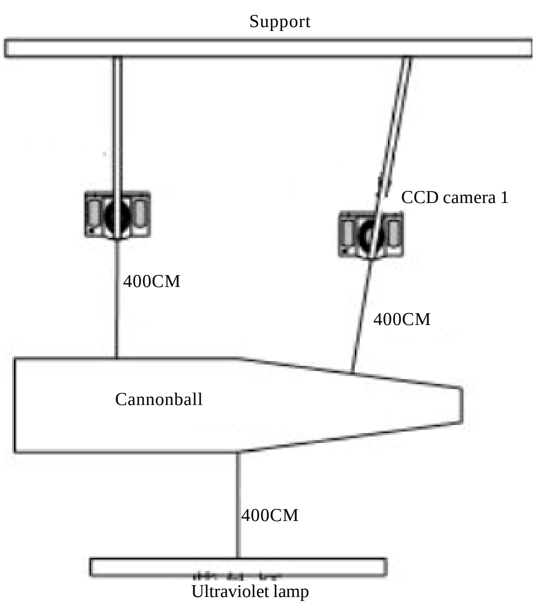

Fig. 3: CDD position

The two CCD cameras are placed as Fig. 3. The four-way real time image collecting card is named DH-QP300 based on PCI bus.

The camera 1 and camera 2 are placed 40 CM above the cannonball as Fig. 3. The camera are placed on the special support and the height can be adjusted between 20~55CM.

The advantage is that we can separately detect the cone part and projectile body of the warhead. Because the CCD camera 2 is specially used for the warhead and vertical to the warhead it decreases the residual error because of the different camera level between the cone part and other parts. So much more accurate images can be collected. At the same time it leaves tow roads video input interface for the following development of the system, so it reduces the update costs of the equipment.

Implement of the image collecting part: The fluorescence magnetic powder image is changed to digital signal through CCD camera and then the digital signal transferred to the PCI image collection card. The image card is controlled by using static link storeroom. At last the date is collected and saved in the EMS memory through the collecting card so as to be processed following.

According to the function requirement of the system, the image collecting includes 7 models such as Open collecting card model, Initialize collection card model'Apply for EMS memory model' Collecting image model'Write bitmap information head model' Show pictures mode Close collection card model. (Zhou and Li, 2005).

The first model is opening collection card model. It is used to start the collection card and check if it is success or not. If it is not success, a starting error message dialog box will appear.

The second model is initializing collection card model. It is used to initiall ze the hardware status of the image card. It is used to setup the video frequency PAL, video frequency format, scan mode, crystalloid frequency and video frequency source route and so on of the collection card.

The third model is applying for EMS memory model. When we use image card collecting data, the needed EMS memory, should be physical continuous. When we start the computer, the EMS memory is allocated and saved to be used by image card and keep not useful for other program when the system running until the system is closed and release the EMS memory. We call this EMS memory part as static EMS memory.

The applying for EMS memory model is used for applying the allocate status of the static EMS memory and applying for static EMS memory. If it is not success, a static EMS allocate error status message box will be returned. If the applying for EMS memory space is bigger than that of the system allocated, an applying for EMS memory exceed range message box will be returned.

Before we use the static EMS memory we need to get the present status of the EMS memory. The static EMS storage appointed by image card includes two statuses: Allocate status and lock status. The allocate status shows if the allocate of the EMS memory appointed by the operating system is success or not.

The lock status shows if the static EMS memory could be locked in the program. After it is allocated successfully, the static EMS memory could not be used by the collecting system until the storage is locked.

The fourth model is collecting image model. It is used to collect one frame image to appointed EMS memory. It setups the video frequency input scope, video frequency output scope, EMS memory used by every frame image and the static EMS memory excursion position of the collecting image through collection card.

The fifth model is writing bitmap information head model. It is used to write BMP bitmap information head according to all the index of the collecting image. It writes the image information such as height, width, phasic depth and so on into BMP bitmap information head.

The sixth model is showing pictures model. It is used to show image data in the EMS memory to the screen.First transfer the image in the EMS memory to user buffer and change the format at the same time, show the image on the appointed window of the screen.

The last one is closing collection card model. It is used to close the collection card and checkout if the collection card is closed successfully or not. If it is not successful then return the closing error status information dialog box of the collection card.

IMPLEMENT OF THE IMAGE PROCESSING PART

The flow of the image processing is as Fig. 4. The fluorescence magnetism powder images are changed into digital signal through CCD vidicon and then send the signal to PCI image collecting card. The image collecting card is controlled by calling static link database. At last the data is collected by image collecting card and then saved in static memory to be processed later.

In real use, the original image got by the system is not perfect, for example, the quality of the original image is not so good because of noise'illumination and ect.. So the image is needed to be processed by image background process model and then we can pick up useful information. The image process includes image enhance'smooth and filter'sharp and ect. (Zhou and Li, 2005).

After the crack is confirmed, the length and width of the crack can be measured and labeled by foreground application model. You can still measure the crack enlarged at the same scale'change the image format and ect. You can adjust the light of the image'zoom out and zoom in the image. At last you can print or save the processed image. The formats of the image are BMP or JPG.

The image processing part includes Data Reading Model, Gray Process Model, Reduce Noise Model, Image Enhance Model, Image Display Model, Image Display Model.

Data reading model: This model is mainly used to read the image data which is collected by CCD vidicon from memory. The image data is saved as BMP format. A BMP file is generally divided into bitmap file head, bitmap information head, color palette and DIB image data. To read the bitmap is to read the four parts of the bitmap.

Gray process model: This model is mainly used to gray the image data. Because of the restriction of time, first the

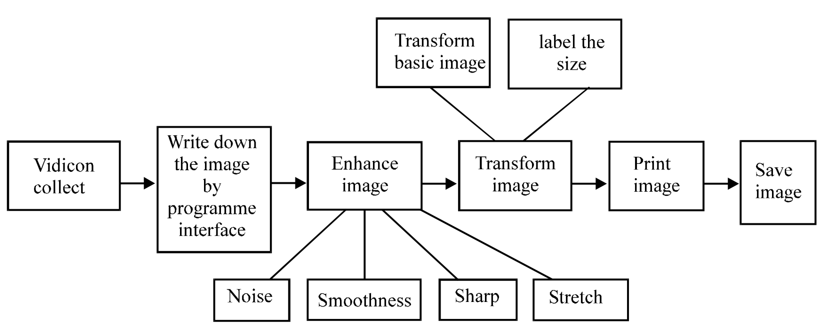

Fig. 4: Flow of the image processing

color bitmap must be grayed so that less the processing quality of image processing.

We can use the transform between RGB color system and YIQ color system to gray the colored bitmap.

The corresponding relationship between RGB and YIQ is as equation 1:

$$\begin{pmatrix} R \\ G \\ B \end{pmatrix} = \begin{pmatrix} 1 & 0.956 & 0.621 \\ 1 & -0.272 & -0.647 \\ 1 & -1.106 & -1.703 \end{pmatrix} \begin{pmatrix} Y \\ I \\ Q \end{pmatrix}$$
$$\begin{pmatrix} Y \\ I \\ Q \end{pmatrix} = \begin{pmatrix} 0.299 & 0.587 & 0.114 \\ 0.596 & -0.274 & -0.322 \\ 0.211 & -0.523 & 0.312 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix} \tag{1}$$

Reduce noise model: This model is the most important processing model in the whole image processing. It is used to reduce noise of the image data to let the image become clear. It uses the open operation and close operation in image morphologic operation to reduce the image noise.

The open operation means corrupting the image at first and then expanding it. The close operation means expanding the image at first and then corrupting the image.

Corruption in math morphologic operation is to proof the verge of object. If we pick up a 3×3 black dot as a structure element, corruption will reduce one pels along the perimeter of the verge of the object. Corruption can get rid of object of small structure element, so when we choose different structure elements we can get rid of different objects. If there is a fine connecting between tow objects, when the structure element is large enough, two objects can be separated by using corruption operation.

Image enhance model: This model is mainly used to smooth the image data, so that the processed image looks clearly.

To smooth image, we can use lowpass filter to get rid of the high frequency disturb. Image smooth is divided into two parts: space field method and frequent field method. For the first one, the normal ways of image smooth are average value filter or median filter. The average values filter slippage on the image using a slippage window which has odd dots. It replaces the gray values of corresponding image pels at the center of the window with the average values of the gray values of every dot in the window. If there is a rule of every dot's power, in other words the coefficient of every dots, in the slippage window during the average process, then we call it add power average values filter. For median filter, the gray values of corresponding image pels are replaced by the middle values in the window. When applying the average value filter or median filter, we can define an n×n window to convenient the programming work. And then pick up the power average values of the gray level of the n×n pels in the window to replace the original gray level of the center pels. The power add to the gray level of every pels is an adjacent measurement of the pels on gray level. The expression of power average values is as equation 2:

$$g(x, y) = \sum_{i=-k}^{k} \sum_{j=-k}^{k} w(i, j) f(x+i, y+j) \tag{2}$$

In equation 2, (x, y) is the center pels of the window; f(x + i, y +j) is the pels of the noise image; w (i, j) is the power value, the size of the window is (2k+1, 2K+1).

In order to avoid the power arithmetic described before to make the whole image become bright or dark, the sum of all of the power values w (i, j) must equal 1.

The power value can also be written as matrix style. The arrangement of every power in the matrix must correspond the location of every pels added power. Usually we call the power values written as matrix style, operation stencil.

Image display model: This model is used to print the finally processed image on computer, mainly displayed as BMP bitmap format. The processing method is similar as the data reading model, so we do not state here.

The system is developed by Visual C++. The detailed implement is not described here.

RESULTS OF THE IMAGE INFORMATION COLLECTING SYSTEM

The result of the image information identity system is as follows. Fig. 5 is the collecting and processing result, the cracks on the cannonball can be judged easily.

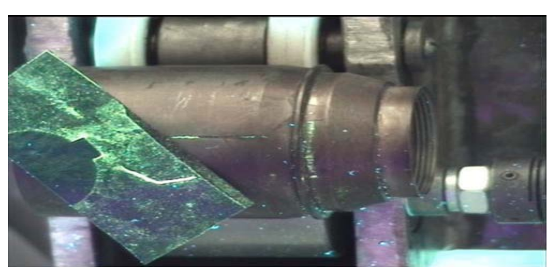

Fig. 5: Result of the collecting and processing

CONCLUSION

It introduces the hardware design and implement of the image information identity system based on the fluorescent magnetic power nondestructive detection of Cannonball. The system is developed by Visual C++. The results are showed. Through the computer aid collecting, image processing, identify, the cracks on the cannonball can be judged easily. The productivity is improved. The research improves the use of image processing technology in the area of nondestructive detection.

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