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VISUAL INSPECTION SYSTEM FOR CRIMP INSPECTION

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ABSTRACT

This research presents an inspection system for determining the quality of crimping. The project work is carried out at the Variosystems (PVT) LTD, which is an international electronics vendor specialized in wire harnesses. Crimps are attached to the wires as a connector. Since the crimps have to be compatible with international standards, they are closely monitored for possible errors. Current inspection done manually, which is expensive and time consuming. This study presents an automated system to avoid these drawbacks, and the performance of the proposed system has been verified by the experimental results.

Keywords: Crimp inspection, Digital Microscope, OpenCV

1. INTRODUCTION

Most of modern industries are tend to automate their manual works to reduce the labour cost and the time consumption. Variosystems is one of leading wire harness manufacturer in the world. There is a crimping section under the wire harness division in Variosystems. It has an automatic crimping machine. This mac hine is used to attach crimps in to the wires. This crimping system is fully automated and it has high rate of crimping. The crimped wires are the output of this machine. After that process the crimped wires are sent to the visual inspection section.

Visual inspection is a quality checking process. It was manual process done by two employees using optical microscopes. They inspect whether the crimps have fulfilled the IPC standards. IPC is a one of international quality standards that conducted by Institute of international electronic and packaging circuits1. According to IPC, a crimp can be divided in to 10 sections but only two selections are mainly considering in visual inspection. They are insulation inspection window and conductor inspection window.

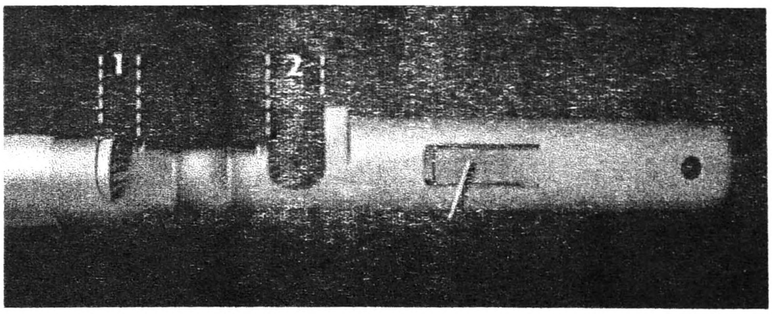

Figure 1: Parts of the crimp

1. Insulation inspection window
2. Conductor inspection window

The inspectors inspect through the windows and check whether the insulator and conductor are properly placed as shown in above figure 1.

Crimping and visual inspection processes are done separately in Variosystems. The crimping process is fully automated. The connectors are attached to the harnesses and disposed at high rate. The inspection of the harnesses are done separately which is a manual, labour oriented task. Two inspectors inspect the harness and check for mal-functions. With a proper automated system the inspection process can be merged to the crimping unit. By that the two inspection can be further improved. This study presents the hardware and software components of the proposed system that can be used for automated, rapid inspection of harnesses.

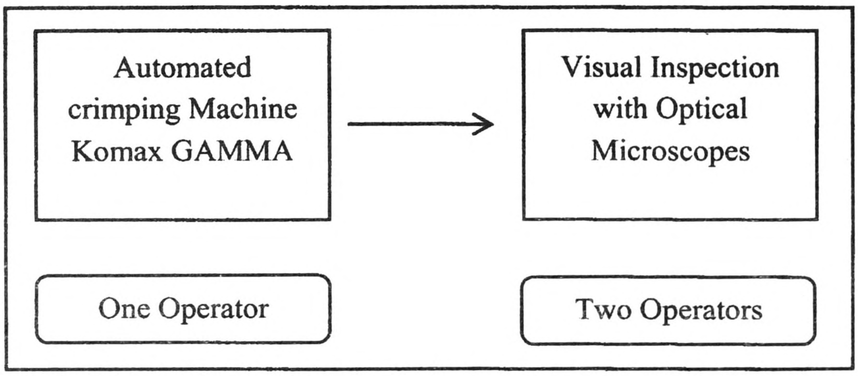

Figure 2: Previous Process

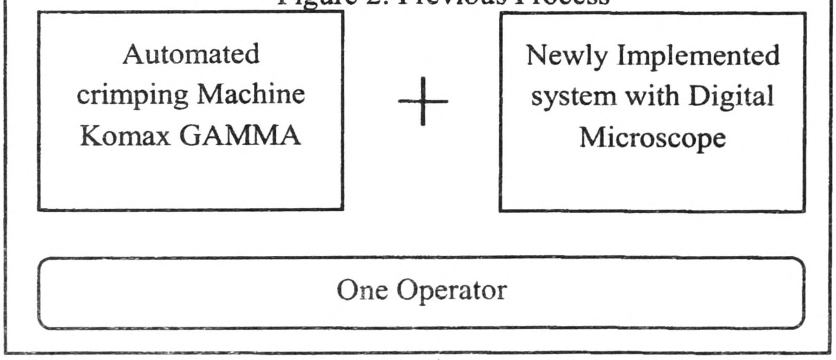

Figure 3: New merged Process

The hardware system consists of a camera and an optical microscope. The camera was mounted on the optical microscope. The software consisted of many features such as Ability of view magnified live image with zooming, Ability of get plugged camera list and switching among them, Taking snaps of viewed image, Maintain a logging system to log the system, Create user account for that logging system, Change captured image save location.

The application software was created by using visual studio 2012 and OpenCV 2.3.1[2] and DirectShow2005

2. EXPERIMENTAL

The suggested solution was created using a camera, an optical microscope, computer and a home-made software. As the first step the software was created to communicate with the PC. The software was created with visual studio 2012 and OpenCV. The connected cameras were identified using DirectShow library3. The logging system was created in the system. All the user names and passwords in logging system were saved in a text files. Then the combination of optical microscope and camera were used to get a magnified image. A camera was mounted on the eye piece of the microscope. Then the system was connected to a PC and adjusted the magnification. Then magnified live image was displayed on the screen.

3. RESULTS AND DISCUSSION

The previous system is a manual labour oriented. They cannot be merged as a one process. After implementing this new process it was simple and easy. When the crimping machine operates the operator can easily inspect one by one simultaneously. The labour cost was reduced due to the omission of the two employees who were inspect manually in previous system.

The developed system was implemented at Variosystems. 100 cables can be inspected with the two systems.

In the previous system

The time taken to finish 100 cable with inspection - 29 mints

No of employees - 3

In the new system

The time taken to finish 100 cable with inspection - 18 mints

No of employees - 1

Compared with the previous system new system saved 11 minutes and also two labours were reduced. Assuming the monthly salary of a one employee is 12000 LKR

Time saving for 100 cables - 11 mints

The cost saving for a month - 24000 LKR

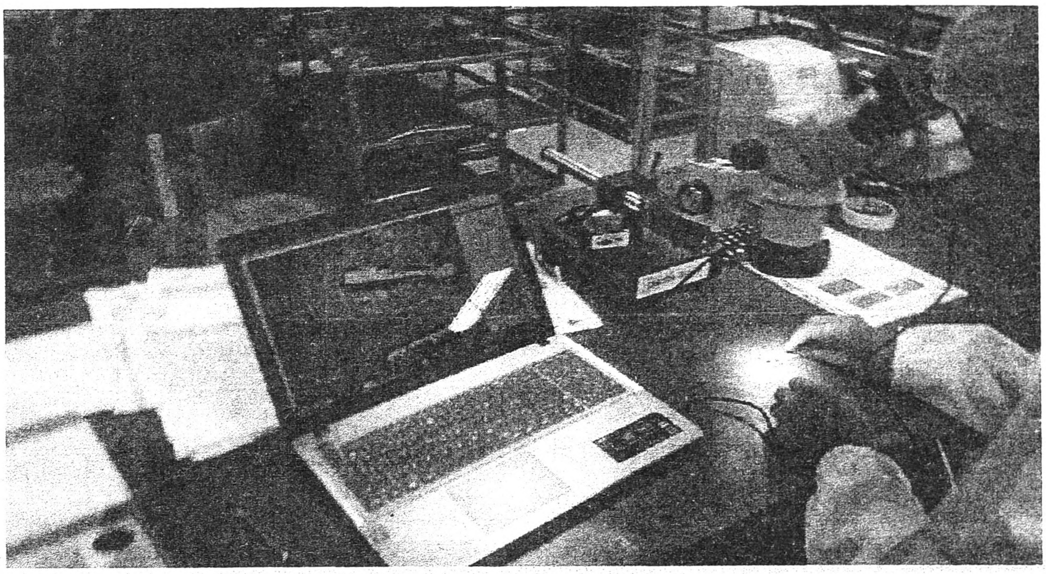

Figure 4: Combine system

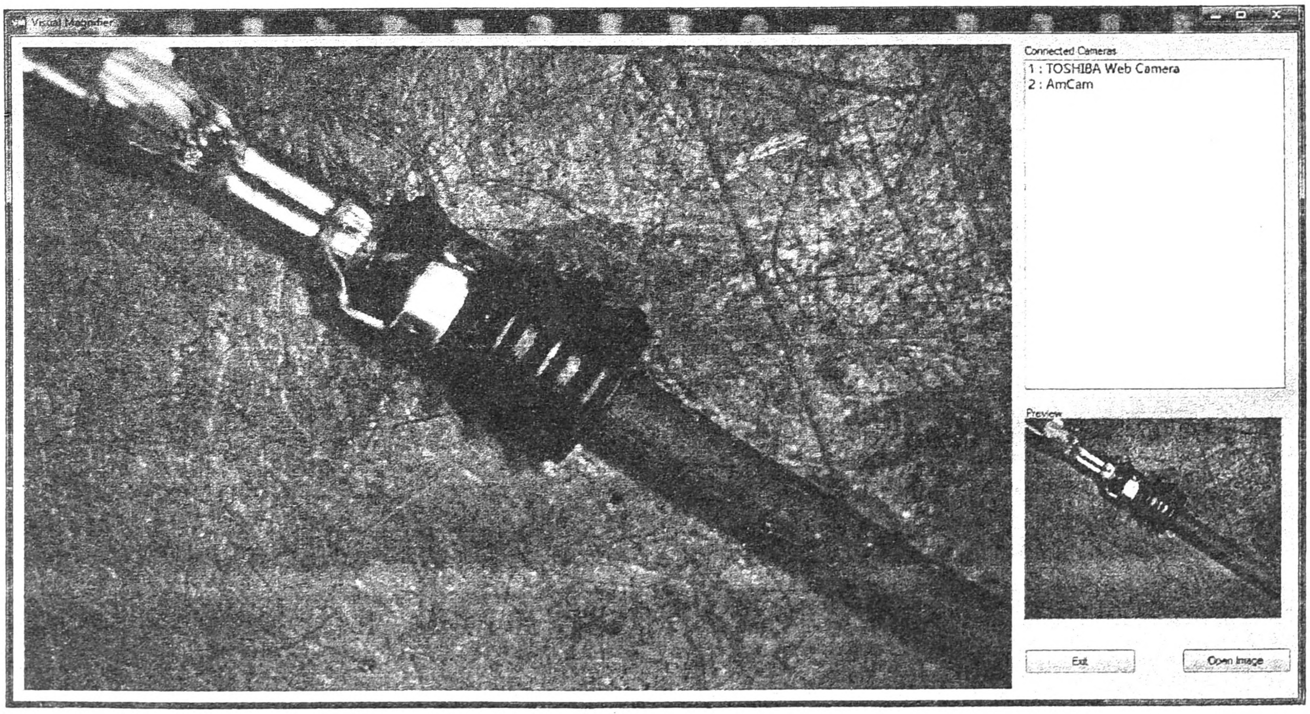

Figure 5: Main Interface of the Software

4. CONCLUSION

A magnified visual inspection system has been implemented. According to the results, the labour cost and time can be saved. If the company makes 1000 wires per day, the total time saving for a day is 110 minutes. So this system monthly save nearly 55 hours of time and 24000 LKR of labour cost for the company. This system can be further developed by using image processing. The application was designed with OpenCV to make compatible with further image processing developments.

ACKNOWLEDGEMENTS

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