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Design and Analysis Ofautomatic Inspection Device

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Abstract: The need for good quality products is felt by the industries to survive in today's competitive market. To achieve 100% good quality, 100% inspection is necessary. Automatic inspection is the only possibility to attain this goal. Hence our project deals with developing an automated inspection system. This paper brings out the cost effective designs and fabrication of robot arm for inspection using machine vision technique. In this system, machine vision technology is used. It constitutes the image acquisition, image processing and image interpretation. Image acquisition is done using a digital camera and rest of the process is done by using an image processing tool from MATLAB software bundle. The digital camera which obtains the image of the object to be inspected is connected to the system where required software is loaded and the necessary programs are developed. The image is processed and the result is interpreted. To further automate the system and to reduce the part handling time a robot arm was designed and fabricated to satisfy the objective i.e. to move near the object to be inspected on the inspection table. Robot arm of required work volume and payloads was designed and fabricated. This robot arm is interfaced through a D.C motor device system to a microcontroller and its motion is controlled. Actuating the robot motion is achieved by interfacing the D.C motor which is used to move the robot arms with microcontroller kit and required circuits. The delays and required programs were generated in the microcontroller program written in it. This program controls the motion of the robot arms. This system involves in reducing the total inspection time and cost involved.

Key words: Robot arm · Microcontroller · Actuation · Automatic inspection · Image processing

INTRODUCTION

Inspection is an inevitable part of manufacturing. Every manufacturing industry has to ensure high quality of the product manufacture to sustain in the today's highly competitive market. Inspection has conventionally been done manually. It involves a lot of expertise on the part of the workers. Therefore the repeatability and the reliability are not up to the standards. The conventional methods of ensuring the product quality involves statistics and hence is time consuming, inconsistent and 100% inspection is not attainable. Hence a good product has the possibility of being rejected and a defective product has the possibility of reaching the customer. As the inspection procedure is monotonous there is a chance of an operator to go wrong so it is always better to make the system human independent, thereby reducing the losses due to human factors [1].

In principle, only way to achieve 100% good quality is to use 100% inspection. By manual methods, this leads to high cost and high error rate. Hence automation of the inspection process becomes necessary. It involves automation of one or more of the steps involved in the inspection procedure. This involves initial cost such as digital cameras, computers, robots etc...But the running costs are limited and the laborers can be utilized effectively for other purpose. This lends itself easy to being integrated with other manufacturing processes [2].

Computer is capable of automating a system without much difficulty and hence it is manipulated to achieve the goal of developing automated inspection system. The accuracy depends upon how far we are able to manipulate its capabilities. A software bundle is used for image processing and image interpretation. Here we have chosen MATLAB software due to its user friendly nature for this project. Particularly in MATLAB, image processing tool is made into use for this particular goal. For acquiring the image mercury digital camera is used in this particular case. This captures the image in bmp format which is accepted by MATLAB [3].

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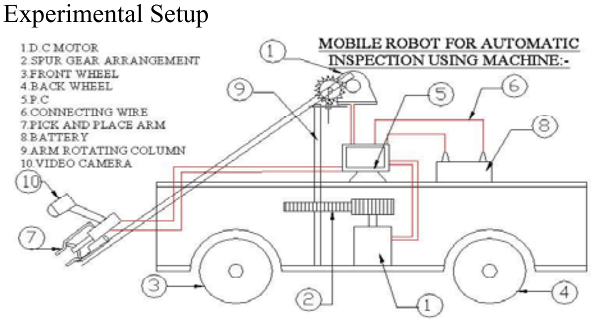
Literature Survey: Elena Garcia, Maria Antonia Jimenez, Pablo Gonzalez DE Santos and Manuel Armada (2007) provided an overview of the evolution of research topics in robotics from classical motion control for industrial robots to modern intelligent control techniques and social learning paradigms, among other aspects [4].

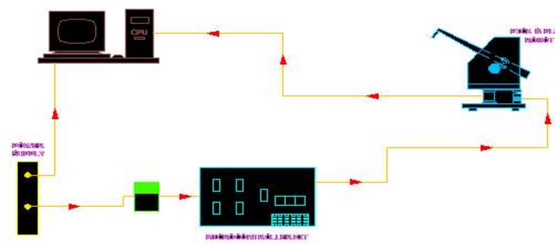
J. Ibaiiez-Guzmh'(1995) described the course structure and the set of laboratory experiments developed as support for the course work. It includes a list of representative final year projects and industrial training internships [5].

D. M. Tsai and S. K. Wu presented a machine vision system for automatic inspection of Defects in textured surfaces found in industry. The defects to be inspected are Those that appear as local anomalies embedded in a homogeneous texture. The Proposed method is based on a Gabor filtering scheme that computes the outputResponse of energy from the convolution of a textured image with a specific Gabor Filter Dr. Mel Siegel (1997) focused, more sharply in hindsight than was possible in foresight; on why building an aircraft inspection robot that actually delivers useful data has proven so difficult. In the course of reviewing the rationale for robotic deployment of NDI equipment for aircraft inspection and describing the major research efforts to date, it elucidates how universal issues in tele operation and automation are manifest specifically in the aircraft inspection environment. In describing the five major and several minor efforts, CMU's contributions of necessity emphasized, as they are best known to the author personally and also most thoroughly documented in print; however it is my goal to be as comprehensive as openly available knowledge permits. The paper concludes by outlining a path to a comprehensive, economical and culturally acceptable system for remote automation-assisted deployment of NDI and enhanced visual inspection equipment [6-7].

Experimental Setup



Final Setup



RESULT

The automatic inspection is done for a simple spur gear surface. The automatic inspection is done by capturing the object using web camera. The captured image is compared with the standard image using MATLAB for analyzing defects. The following GUI interface dialogue box shows the compared results [8-9].

CONCLUSION

The automated inspection system based on machine vision technology was developed. Robot arm to automate the system was designed and fabricated. The end effectors are electromagnetic type and thus object to be inspected is limited to ferrous components alone. The weight and size of the object is also limited according to the torque given by the end effectors. Inspection system using the image-processing tool was developed and the programs were written to find the object to be inspected [10-11].

As a future scope of our project, more analysis of the image processing can be done and further be extended to 3-D objects. End effectors of the robot manipulator can be developed to suit other materials and can be designed for higher torque value to lift heavier objects.

REFERENCES

1. Aluze, D. and F. Marianne, et al., 2002. Vision system for defect imaging, detection and characterization on a specular surface of a 3D object. Image and Vision Computing, 20: 569-580.
2. Eiden, G. and M. Kayadjanian et al. 2000. Capturing landscape structures: Tools. Available via: http://ec.europa.eu/agriculture/publi/landscape/ch1.htm#1 Accessed 25 April, 2009.

3. Guda, P. and J. Cao, et al., 2000. Machine Vision Fundamentals. Handbook of Industrial Automation, R.L. Shell and E.L. Hall, Editors, Marcel Dekker, New York, In press.
4. Guise, M., D.K. Poe, et al., 2002. automated defect pattern recognition: An approach to defect classification and lot characterization. Available via: http://www.sys.virginia.edu/students/capstone/past/cap2002/2002-01.pdf. Accessed 25 April 2009.
5. Iivarinen, J. and A. Visa, 1998. An Adaptive Texture and Shape Based Defect Classification. 14th International Conference on Pattern Recognition (ICPR'98) 1: 117.
6. Chen, F.Y., 1982. Gripping mechanism for Industrial Robots, Mechanism & machine theory, 17(5): 299-311.
7. Engelberger, J.F., 1980. Robotics in practice, AMA COM (American Management Association), New York,
8. Austin Hughes, 1990. Electric Motors and drives ’-Fundamentals types and applications-British Library Cataloguing in Publication Data.
9. Elena Garcia, Maria Antonia Jimenez, Pablo Gonzalez DE Santos and Manuel Armada, 2007. The Evolution of Robotics research.
10. baiiez-Guzmh, J.I., 1995. A Robotics and Automation Teaching Laboratory.
11. Tsai, D.M. and S.K. Wu-Automated, Surface Inspection Using Gabor Filters.