Design Firmware for 360 Degree Imaging and Calibration Using Virtual Instrumentation

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Abstract **— This paper aims to design a firmware for calibrating multiple images from the target plane and comparing with the reference images using LabVIEW. In LabVIEW the vision and motion function used for processing the captured images from the web camera. The images should be acquired for every 5 degree twist in 360 degree view and totally 72 images can be acquired from the target plane. The target plane is a 6*6 square grid plate (chess board). The Region of Interest of the target image is the inner 4*4 for all images. The output of this project is to compare the acquired image with the reference image. This project is mainly used for the Automatic testing process in order to control the execution of testing and comparison of actual outcomes with predicted outcomes.**

Keywords **— Edge detection, Pattern matching, ROI, LabVIEW.**

I. INTRODUCTION

Our project is to the acquiring the images from the target plane by using the web camera with the CMOS sensor. The web camera with the CMOS sensor consumes less power and high accuracy In Lab*VIEW* the IMAQ function is used for calibrating images from the web camera. The Personal Computer with the Lab*VIEW* can be interfaced with the web camera. The web camera with the CMOS sensor can be rotated with the help of the stepper motor in 360 degree view. By using the edge detection and pattern matching function in the Lab*VIEW* the acquired images can be processed accordingly. In each 5 degree rotation of the camera images will be compared with the reference images which are already stored in the Personal Computer. Totally 72 images can be required for completing this process. The images could not be identical with the reference images which is stored in the personal computer means it wills gives an error pop-up window otherwise it will never gives an error pop-up window. The captured images are also stored in the Personal Computer. In this system is mainly used for the profile matching system and Automatic Testing industry such as chemical and oil refinery system.

II. ANALYSING THE PROBLEM IN EXISTING SYSTEM

The existing system uses multiple cameras for capturing single image as a 360 degree view. The cost of the CMOS camera is less. The web camera with the CCD sensor can be used for calibrating images from the target plane. The CCD sensor in a web camera has following drawbacks such as quality of images will be very low, it consumes more power for processing and it requires more IC's. To overcome this kind of problem we are using web camera with the CMOS sensor. The quality of image will be high in the CMOS sensor compared to the CCD sensor. The CMOS sensor has less expansive.

III. HARDWARE AND SOFTWARE DESCRIPTION

Software

- Lab*VIEW*

Hardware

- Web camera with CMOS sensor
- Stepper motor
- Target plane

IV. CONCEPT OF BLOCK DIAGRAM

- This proposed system can be built for acquiring images from the target plane by the use of web camera with the CMOS sensor.
- The stepper motor and web camera with the CMOS sensor can be interfaced with the Personal computer with Lab*VIEW*.

V. MODULES OF BLOCK DIAGRAM

1. Web Camera with CMOS Sensor

- The images can be acquired by using web camera.
- It has high accuracy, consumes less power.

2. Stepper Motor

- The web camera can be rotated with the help of stepper motor for acquiring the images from the target plane in 360 degree view.
- It has high responsible for start, reverse and stop function.
- The error in the first step of the stepper motor will not be cumulated to the next step for processing.

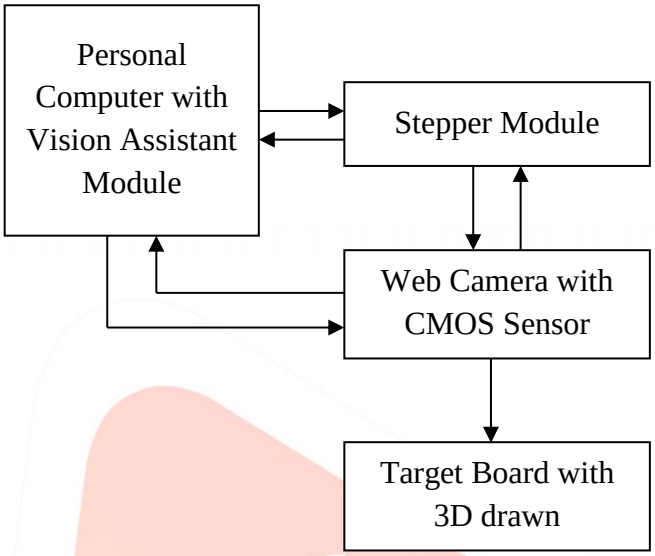

Fig. 1 – Block Diagram for 360 Imaging and Calibration

VI. CONCEPT OF SIMULATION

- When the button presses in the Lab*VIEW* the simulation process will be started.
- After the button presses the web camera can be acquiring the images from the target plane.
- The captured image will be compared with the reference images.
- It takes few seconds for processing.
- The error pop up window will be shown if the acquired images from the web camera will not be similar to the reference image which is stored in the Personal Computer.

VII. SIMULATED OUTPUT

The front panel of the 360 degree image processing has the original image and the processed image. The original image is the reference image that is already stored in the PC. The processed image will be displayed in the rotation snap in the front panel. The analysis process will be carried only the test button presses on the front panel. The figure 8.1 shows the front panel of the 360 degree image processing.

The hardware of the 360 degree image processing is shown in figure (2) proposed an effective method for matching the images to reference image. Our method uses to match the actual image into reference of property images in a common representation framework. Many opportunities for future research stem from the results shown in this work.

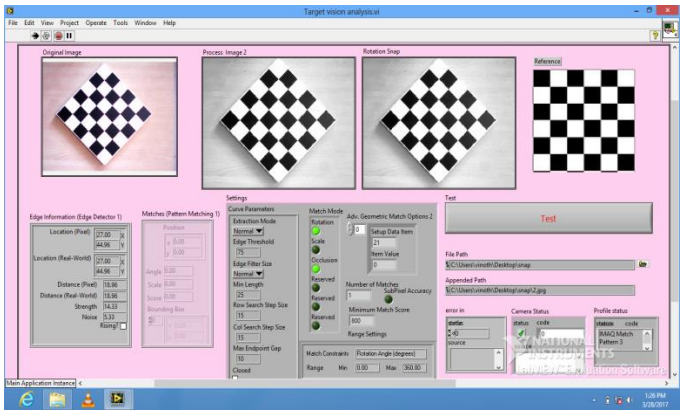

Fig. 2 – Front Panel of 360 degree image processing

This proposed system a 360 degree imaging and calibration using virtual instrumentation. The images can be acquired from the target plane by using the web camera and can be rotated every 5 degree twist .The acquired images will be compared with the reference images which are already stored in the personal computer for profile matching. The compared image will be a high accuracy.

In this paper uses single camera instead of multiple cameras for acquiring single image. It can be used for automatic testing purpose.

Fig. 3 – Hardware of motor control and interface

The figure (3) shows the hardware setup of the motor control and interface. The Arduino controller can be interfaced with the Personal Computer using the Arduino cable. The web camera captured image from the target plane. The captured image will be displayed on the Personal Computer.

VIII. APPLICATIONS

- It can be used for automatic testing industry such as chemical and oil refinery system.
- It can be used for profile matching system.

IX. CONCLUSION

This proposed system a 360 degree imaging and calibration using virtual instrumentation. The images can be acquired from the target plane by using the web camera and can be rotated every 5 degree twist .The acquired images will be compared with the reference images which are already stored in the personal computer for profile matching. The compared image will be a high accuracy.

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REFERENCES

[1] Hua-Tsung Chen “Geometry based camera calibration using five point correspondences from a single image” in proceedings accepted for IEEE journal publication.

[2] CongiLyu et al., “Design of a high speed 360 degree panoramic video acquisition system based on FPGA and USB 3.0” in proceedings accepted for IEEE journal.

[3] Fanni Molnar, Andres Kovacs “360 degree image stitching with GPU support in proceedings 20th Jubilee IEEE international conference on Intelligent Engineering Systems-2016.

[4] Chung V. Nguyen, JurgenFripp "3D scanning system for automatic high resolution plant phenotyping" in proceedings IEEE journal in 2016.
[5] KeyinZheng, Xiaoming Li, "The quantitative analysis of self calibration based on rotating cameras" in proceedings 7th International congress on image and signal processing in 2014.
[6] Shinzo Koyama, KazutoshiOnozawa "A 3D Vision 2.1MPixel Image sensor for single lens camera systems" in proceedings IEEE International solid state circuits conference in 2013.
[7] HafedAbdelhamid, WengDongDong "360 degree imaging systems design, implementation and evaluation" in proceedings International conference on Mechatronic Sciences, Electric Engineering and computer in 2013.
[8] Yun Lin, Yu Sun "5D force control system for fingernail imaging calibration" in proceedings IEEE International Conference on Robotics and Automation in 2011.

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