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Survey on Implementation of Machine Vision System in Determination of Work Offset in CNC Machining Centre

[1]C. Bhagyanathan, [2]S. Natchi Muthu, [3]M. Rubanraj, [4]K.Prasanth
[1]Associate Professor, Department of Mechanical Engg, Sri Ramakrishna Engineering College,
[2,3,4] Department of Mechanical Engineering, Sri Ramakrishna Engineering College,
Vattamalaipalayam, NGGO Colony (Po.), Coimbatore-641022, Tamil Nadu,India.

Abstract:-Automation becomes a most common way for production and analysis for many other purposes. The survey is going to deal with the determination of work offset in a CNC machining center. To measure the dimensions of the objects, methods like calibration, grammatical measurements of the work piece to identify the centre point of the work piece to determine the work offset. It is necessary to determine the work offset to get the perfect finishing of the work piece or else there will be some imperfections in the work piece. Finally, we are going to determine the work offset by using following techniques.

Keywords: - CNC Machine, Calibration, Work Offset, Automation, Grammarly

I. INTRODUCTION

To obtain a perfectly finished work piece we must check that the operations are performed properly and the other thing is to check whether the work piece is clamped correctly to avoid the work offset which results in imperfections. In CNC machine, if the work piece is misplaced from its original position to another position is known as work offset. If the coordinates of both the work piece and the tool piece are not in a straight line, then the work piece is offset from the original position. The work offset in the CNC machine is the reason for imperfections in the machined products. To overcome this problem, we are in need to determine the work offset in the CNC machine. The determination work offset is done by some IOT concepts by using machine vision system. Machine vision is a system which includes many technologies, integrated systems, software and hardware and for monitoring purpose. Machine vision is a technology or method which is used for automatic inspection and many other analyzing purposes. The automatic inspection in the machine vision system is based on the image-based inspection. In this review paper, we are going to deal with some methods in determining the dimensions of the work piece by means camera calibration, photogrammetry, stereometric scanning etc..Calibration is a method which helps to measure dimensions of an object by scanning the object using lasers or by using cameras to measure. Photogrammetry is done by taking the images of objects and then measuring the objects by using photographs.

II. LITERATURE SURVEY

A. Calibration

J.J. Aguilar [3] demonstrates the determination of work offset in a CNC machine by using the camera calibration method and measuring the objects by using CCD cameras. The measurements of the objects are made by using the coordinate measuring machine and by using some calibration methods. The calibration is done by comparing the standard values with the values that are calculated by using the CCD cameras (Fig.1). The calibration is used to find the geometry, position and orientation. When the calibration process is done then the object is measured by forming graphs by using the lasers which help in scanning the objects inside the CNC. After measuring the dimensions of the object the center point of the object if found. The process of self calibration the object then undergoes an OMM calibration to get a precision measurement. The calibration is done by capturing different images from different angles and different views so that we can solve the corrections in the object in many ways. The captured image is solved under a condition of analyzing the 2D image of the object and then comparing the obtained values with the original 3D image of the object. The cameras used for calibration is mounted inside the machine for the easy analysis and for the purpose of obtaining a clear image of the objects.

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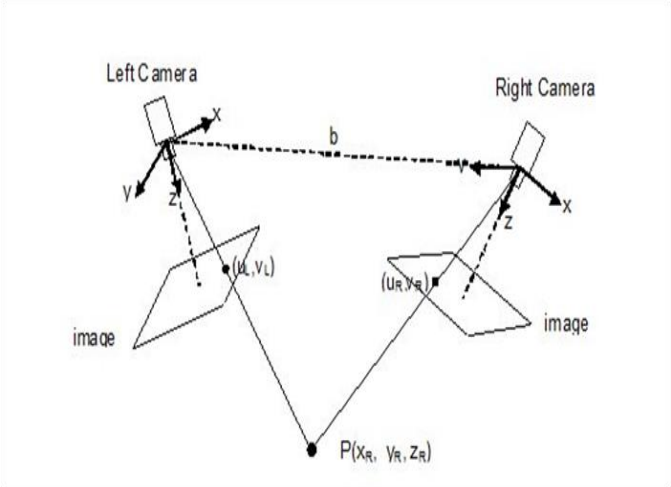

Fig 1.Calibration [3]

B. NC Programs

Martin Hardwick [6] demonstrates the study of enabling machine vision system by using Step-NC. The main application of Step-NC is to measure the surface of the objects by machine vision system. Here the geometry of an object is measured with the help of capturing the image of the object using cameras. The object is measured by using NC programs which is useful in performing operations. Using the CAM software the path used for performing operations like material removal or material addition by machine head are generated which is also used in measuring the dimensions of the object by performing the operations by the generated path. The generated paths are then stored in the Step-NC along with the geometrical design features of the object to be measured or machined. Step-NC is operated in a short period than the other methods like using cameras, projectors and sensors which are used only inspection and measurement.

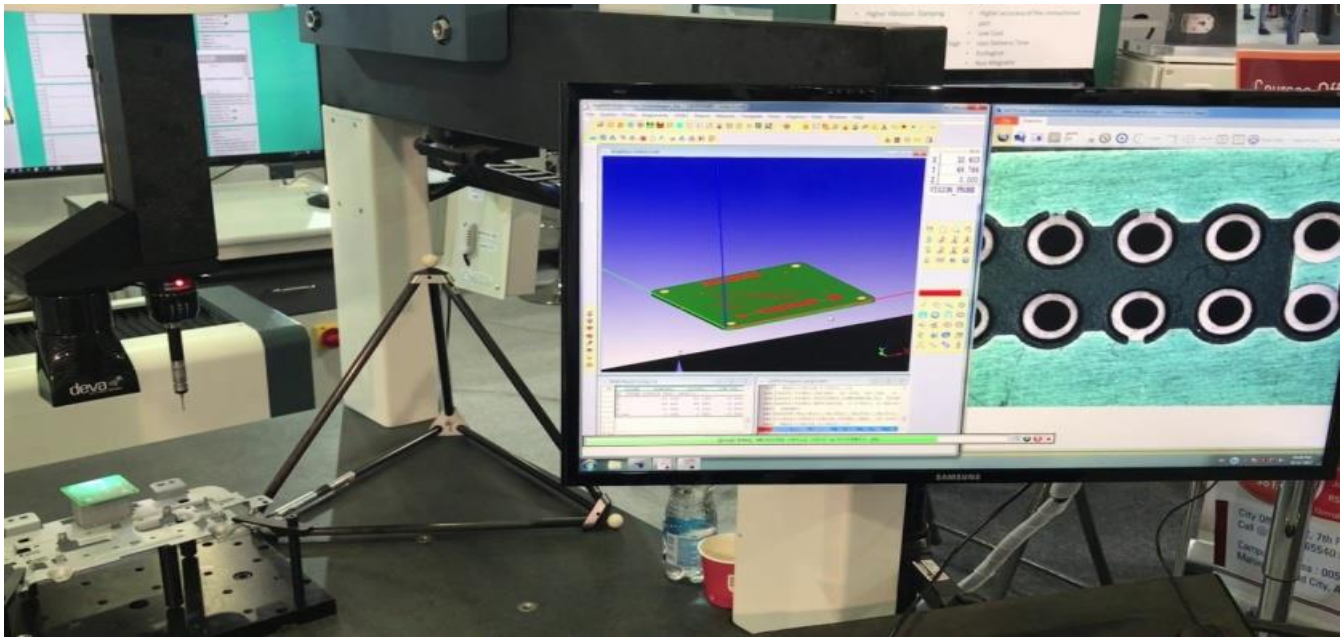

Fig.2 Program Measurement Using Touch Probe [6]

Phansak Nerake[8] describes the method of measuring the objects based on the image processing done by LabVIEW NI software where the images are taken by using the cameras. The shape, orientation and geometry of the objects are obtained by image calibration method. The assembly of the parts is controlled by the selective compliant articulated robot arm(SCARA). By using this SCARA method, the automatic assembly system could detect the shape, orientation and geometry of the object. The SCARA is at the center of the base and when the parts come to the position the camera takes the images of the object and then the image is sent to the LabVIEW NI software where the image is analyzed. In LabVIEW, the image is processed by capturing the image then finding the edge followed by shape recognition of the object. Since the camera is not exactly perpendicular to the object, there will be some distortion in the image. Hence the image must be calibrated to get a perfect output. The calibration is done by comparing the obtained image with the standard values.

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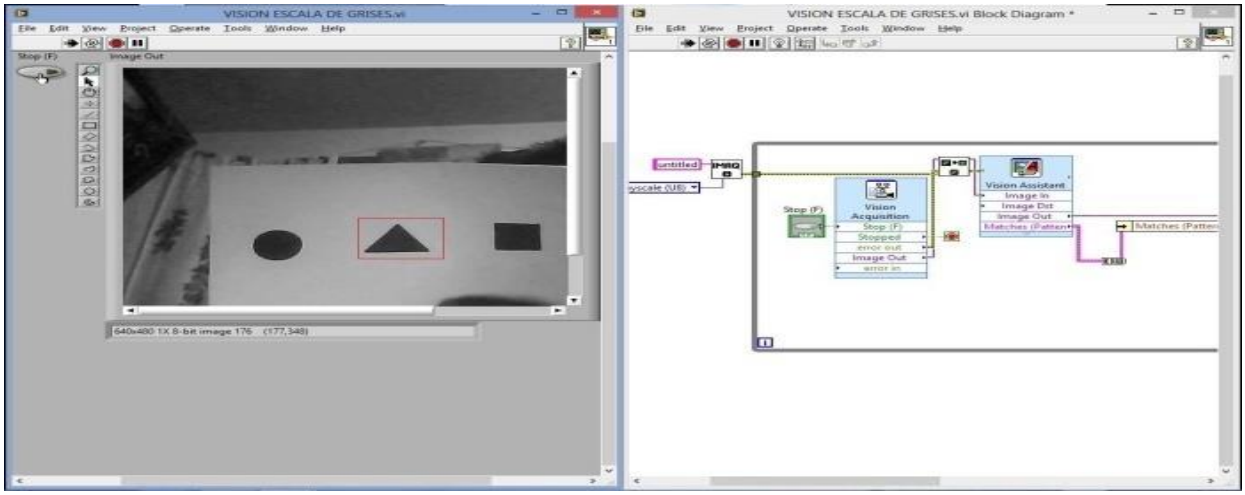

Fig.3 Captured Image In Labview NI [8]

Alberto Mendikute[2] demonstrates the method that deals with the study of self-calibration technique for on machine mounted vision system. On machine, measuring is used to measure the work piece dimension and orientation by using cameras in the machine itself by using placement vision system. Coordinate measuring machines (CMM) are used to analyze the dimensions of the smaller objects as well as larger objects. Since the obtained dimensions are not exactly correct some additional methods like calibration, touch probing, etc.. are used to find the exact dimensional values of the objects. The method used in measuring the dimensions of the objects is machine photogrammetry. Initially, the object is measured by photogrammetry method outside the machine by using the retroreflective coded and noncoded targets. The 3D coordinates of the object are measured by taking the images of the object with the help of cameras. The part surface is measured with the help of noncoded targets. The on-machine system uses the reference generated by the coded targets. After finishing the raw part setup, the measuring process begins based on the reference generated by the noncoded targets. By measuring the reference parts of the object with the help of on-machine measuring machine system, there will be some corrections in the values which are corrected by means self-calibration by the use of the stereo photogrammetric method.

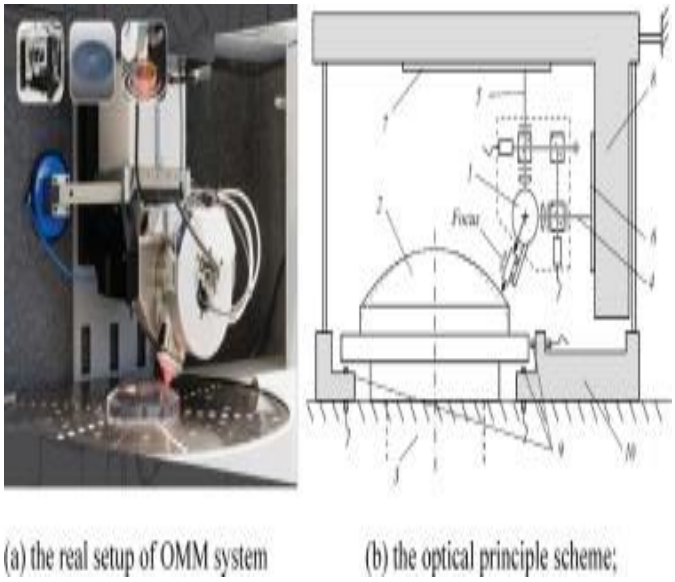

Fig 4. Stereometry in OMM[2]

C. Photogrammetry

Krzysztof Okarma[9] describes the scanning of the objects done by photogrammetric methods using fringe pattern approach. Here the object is scanned by the cameras to obtain a photographic view of the object. The object is then scanned by using the projector by combining the photogrammetric procedure with the stereo vision to develop a fringed pattern(Fig.2).The fringes are like dark and bright band arranged alternatively in a series manner. The fringed patterns are then compared and analyzed with the original object to find the pattern shift in the observed fringed pattern to check

whether the object is misplaced from the original position or not. Then calibration is done to find optical centers by using cameras and projectors. The calibration is done by taking images of the objects with the help cameras and projectors, and the images are verified and analyzed. The calibration is done by comparing the coordinates of the 3D object. Then finally the object is placed in the CNC with the help of machine vision system.

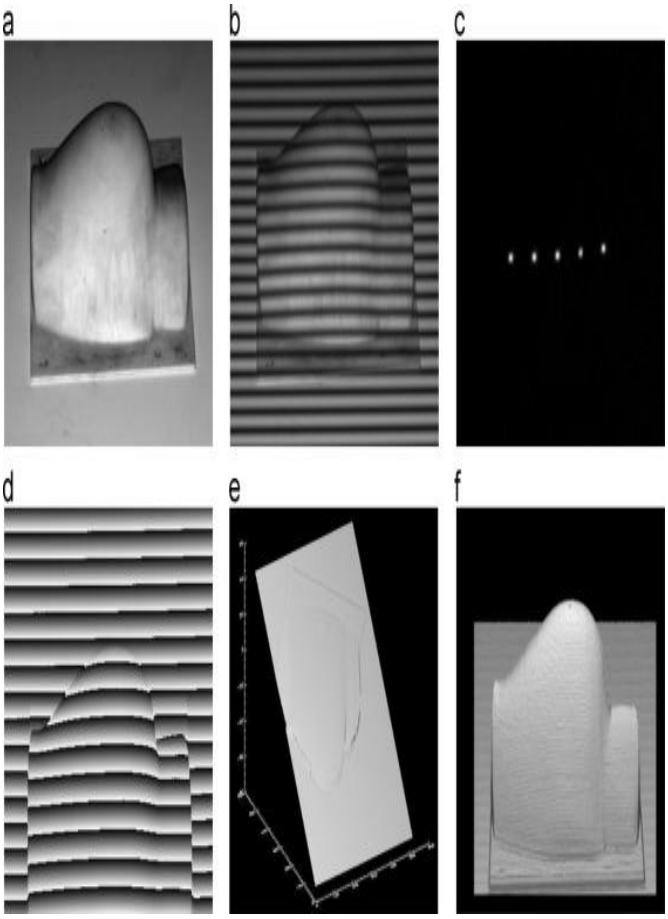

Fig.5.Photogrammetric Fringes [9]

M. Zatarain[1] demonstrates the method used in the study of raw part alignment by using machine vision system. The alignment process is based on the 3D vision technology which in reducing the part alignment time. The alignment process is done in two method such as part characterization and part setting. Here the part charaterization is done by comparing the testing object with a standard object to define the geometry, orientation, etc.. the fiducials are used, by measuring the position of the machine coordinates with the help of touch probes or with the help of the tool. Since there are many solutions for the part charaterization, stereometric scanning and laser radar are used which can produce a 3D image of the complete part. From this methods, the parts produced have some limitations and to measure some specific parts laser tracker and photogrammetry.To increase the precision of the measurement, the geometry obtained by the photogrammetrical method is compared the calibrated reference. The geometry is measured using coded and uncoded targets where the coded targets are used to calculate using the camera location.

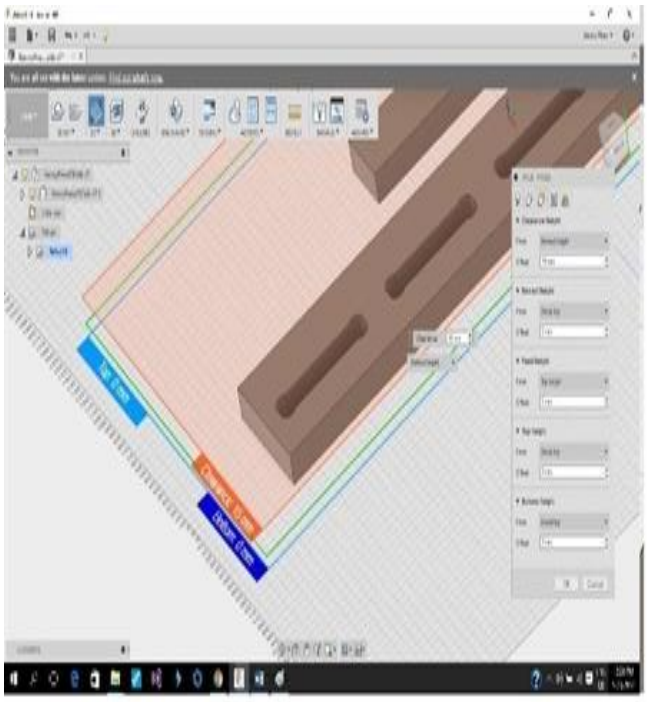

Fig 6.Part Characterization[1]

D. Laser Measurement

Radovan Kovacevic[5] describes the measurement of objects using lasers are done with the help of three modules namely a laser-based vision sensor, image processing sensor and a multi axis motion control module. The laser sensor is mounted in a vertical axis from where it can scan the full length of the material and then the scanned data is reconstructed in the image processing module. CCD cameras and the focus lens are used to scan the material. The scanned data is then processed in the image processing module where the image is processed

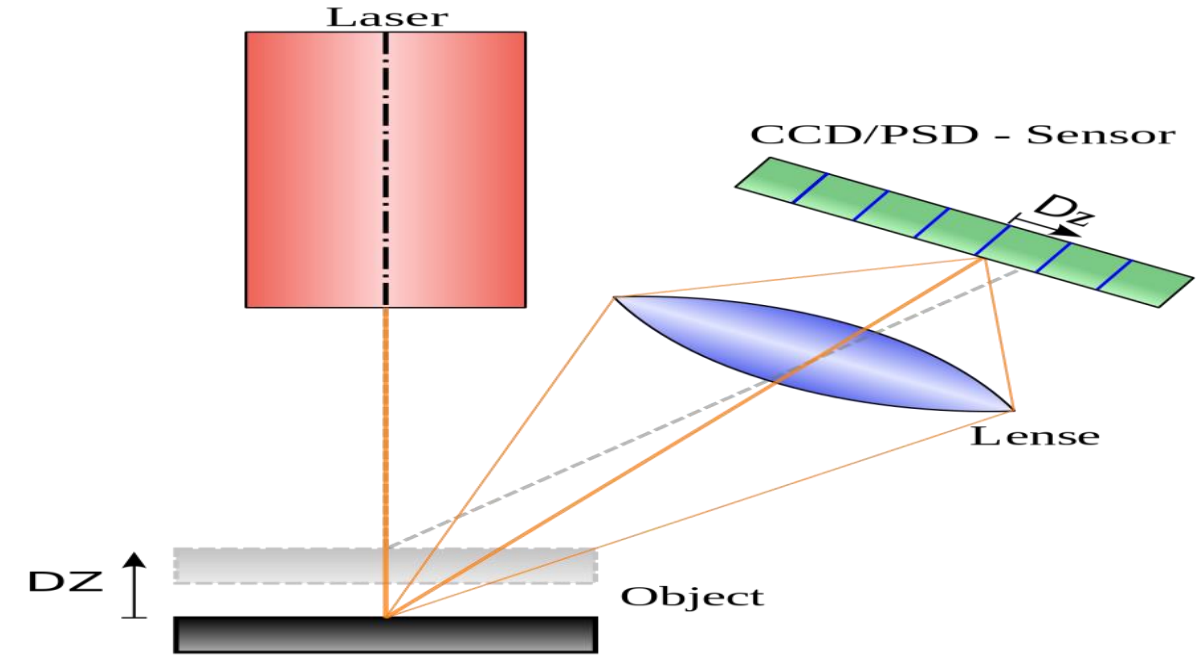

Fig 7. Laser Measurement[5]

III. CONCLUSION

In this paper, we have discussed many concepts like calibration, photogrammetry, stereophotogrammetry, LabVIEW NI, a laser method, part characterization and NC programs. Since all the methods are suitable to measure the dimensions of the material, calibration and photogrammetry are the best methods to find the dimensions of the material. Calibration is most commonly used in all the above-mentioned methods so we can assume that calibration can never be avoided by measuring the dimension of the material. Photogrammetry method gives the very exact geometry of the material it can be adopted to measure the dimension of the material as well other methods also gives the correct dimension of the material they can also be used concerning the type of machines in which we are performing the operations. After finding the dimensions of the materials, we can able to determine the center point of the object from which we can able to determine the offset of the work in which the operations are performed. These are some methods from which we can determine the work offset in a CNC machine.

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