Bridge Type 3 Dimensional Scanner for Automation
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Abstract — 3 dimensional scanners has been used to verify accuracy of components. Customary 3 dimensional scanners agonize from a big hindrance – cost and manual motion. The high cost of existing 3 dimensional scanners have limited their application to only large industries, sampling application and where the huge purchase cost and operating cost can be delivered. This paper aims are providing a solution for this striving. The following work describes the development of a 3 dimensional scanner suitable for providing eminence control at a reasonable price and complete automation.

Keywords—3 dimensional scanner, assessment, quality regulator.

I. INTRODUCTION
A 3 dimensional scanner or CMM is a machine for authenticating the physical geometrical traits of a component against the ones prescribed. The machine has supplementary applications for measurement of features, form, positioning, etc.

1.1 Classification
CMM may be classified as per the given conditions:
On the basis of the connexion made by probe
Contact type.
The probe tip makes contact at the anticipated point and the coordinates of this point are recognized.
They are most widely used due to less intricacy in control and design. They are more prone to errors and tip wear is common.
Non-contact scanning.
The probe is one of the following types and does not make contact with the module surface.
e.g. High speed laser point triangulation, Laser scanning.
On the basis of number of Axis
2 axes: It consists of gesture only in two directions, usually X and Y axis.
The first CMM of this type was established by the Ferranti Company of Scotland in the 1950s.
3-axis:This is the most extensively used type of CMM.
It has motion in all three axis – X, Y and Z.

The first prototypical of this type began appearing in the 1960s (DEA of Italy).

II. CONFIGURATION
The most popular CMM configurations include
1. Articulated arm.
2. Bridge.
3. Column.
4. Fixed Table Cantilever.
5. L-shaped Bridge.

III. DESIGN CONSIDERATIONS CONCEPT
A. Work piece size
As a base for further progress of the CMM, the maximum component size (maximum foldaway along the axis) is nominated as 500x500x300.
B. Configuration medley
The different arrangements are considered from manufacture point of view, and it is found that the scaffold configuration is most suitable because of the following potentials.
C. Provides better stringency.
D. Improved exactness.
E. Ease of maneuver and programming
F. CMM components
The CMM is divided into three sub systems. These are
i. The CMM edifice.
ii. The Electrical organization.
iii. The Suite.

IV. MECHANICAL SUB ASSEMBLIES
The CMM structure is auxiliary divided into succeeding sub-assemblies.
Frame, X, Y and Z sub assembly
Four L cross section sunbeams welded together to form each of the top and lowest part of the configuration. Four more beams are bolted vertically to these portions to form the frame structure.
Two beams are placed parallel along X axis and bolted to the vertical beams to form the guides for the X axis base.
X axis sub assembly
Two bearings are positioned on both sides of the X axis screw. These bearings are then braced in the bearing seat provided in the side plates. A mid plate is delivered which has internal threading for connection with the screw. Two guide rods are fit amongst the two side plates. Each of the side plates has two M6 taps at the bottom to screw them to the frame. The motor is fastened to the motor provision plate which is in turn attached to the guide rods. The shaft of the motor has a radial hole which is used to link the motor to the screw.

V. HOW DOES KAIZEN WORKS?
Kaizen is top-to-bottom programme. It is responsibility and interest of the top management to inspire the human resource of the organization and inform them about what’s, Why’s, and How’s of kaizen. The basic steps to incorporate kaizen as an enterprise-wide programme consists of the 4I’s:
1. Inspire  2.Inform  3.Implment  4.Improve

VI. DESIGN CALCULATIONS
X lead screw
The drive required is \( = 400\text{mm} \)
For safer side picking length of screw as \( = 500\text{mm} \)
Size \( = \text{M10 x 1} \)
Pitch, \( p \) \( = 1 \text{ mm} \)
Major diameter, \( d_o \) = 10 mm
Mean diameter, \( d = d_o - p/2 = 10 - 1/2 = 9.5 \) mm

Y lead screw

The movement mandatory is \( = 400 \) mm
For safer side electing length of screw as = 500 mm
Size = M10 x 1
Pitch, \( p = 1 \) mm
Major diameter, \( d_o = 10 \) mm
Mean diameter, \( d = d_o - p/2 = 9.5 \) mm

Z lead screw

The movement mandatory is \( = 200 \) mm
For safer side selecting distance of screw as= 300 mm
Size = M10 x 1
Pitch, \( p = 1 \) mm
Major diameter, \( d_o = 10 \) mm
Mean diameter, \( d = d_o - p/2 = 9.5 \) mm

Power scheming

The capacity on the Y axis is maximum, hence the power required at Y axis sub assembly will be maximum. Hence the power required at Y axis lead screw is considered for choosing the motor. The power required is deliberated next.

\[
\text{Co Co-efficient of friction, } \tan \theta = \frac{p}{d_o} = \frac{1}{10} = 0.0318
\]

\[
\text{Mass on lead screw in Y-direction, } m_y = 5 \text{ kg}
\]

External force, \( F_{ey} = m_y \times g = 5 \times 9.81 = 49.05 \text{ N} \)

Frictional force, \( F_{fy} = \text{selecting } = 0.0015 \times 5 \times 9.81 = 0.0736 \text{ N} \)

Total force, \( F_y = F_{ey} + F_{fy} = 49.05 + 0.0736 = 49.1236 \text{ N} \)

Tangential force required at the circumference of screw is,

\[
F_Y = F_y \times \left( \frac{\tan \theta}{\tan \theta} \right) \times \frac{d}{2} \times \frac{\tan \theta}{\tan \theta} = 49.1236 \times \frac{0.0318+0.0015}{1-0.0318\times0.0015} = 1.636 \text{ N}
\]

On the basis of tangential force torque required for screw rotation is,

\[
T_Y = F_Y \times d/2 + \frac{\tan \theta}{\tan \theta} \times F_{FY} \times R = 1.636 \times 10/2 + 0.0015 \times 49.1236 \times (10/2)
\]

\[
= 8.5484 \text{ N-mm}
\]

\[
= 0.0854 \text{ Kgf-cm}
\]

Speed of lead screw, \( N_Y \)

\[
N_Y = 30 \text{ rpm}
\]

Angular speed, \( W_Y = 2 \pi \cdot N/60 \)

\[
= 3.14 \text{ rad/sec}
\]

VII. ELECTRICAL AND ELECTRONIC SYSTEM

First requirement is a clear vision in top management second would be the cultivation of the right attitude or work culture, which would perhaps be more important than superb products, good ideas or technical innovations.

The third need for championship mentality and team work. So far the implementation of lean manufacturing is the company particularly for the small scale manufacturing units. The arrangement has to bring about the following TECHNICAL CHANGES:

A. Motor selection

The power requisite to operate the system has been calculated. Pretentious frictional losses and factor of safety, the subsequent motor is selected

<table>
<thead>
<tr>
<th>Type</th>
<th>Stepper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>30 rpm</td>
</tr>
<tr>
<td>Current</td>
<td>1 Amp</td>
</tr>
<tr>
<td>Voltage</td>
<td>12 V</td>
</tr>
<tr>
<td>Torque</td>
<td>2 kgf.cm</td>
</tr>
</tbody>
</table>

B. Power supply

Current of 1 ampere is provided to every motor by means of adapter whose input rating of 100 – 240V and 0.4 Ampere (max) while output rating is 12 volt and 1 Ampere

![Fig.6 X axis sub assembly](image)s
VIII. SOFTWARE SYSTEM

The working of the diverse buttons is elucidated next

Reset axis button
- When the ‘Reset axis’ button is clicked Motor for X axis starts to revolve in counter clockwise direction and starts to bring the axis to its home location.
- The motor stops when the X axis proximity sensor is stimulated. This specifies that the home location has been touched by X axis. The motor for Y and Z also accomplish similar purpose.

Get Z coordinate
- When the ‘Get coordinate’ button is clicked,
- Motor for X starts to rotate in clockwise direction. The motor stops when the value indicated in the “X” dialog box is reached.
- Motor for Y also works in analogous technique.
- Motor for Z starts to rotate in clockwise direction. The motor stops when the probe proximity sensor is activated. The corresponding Z coordinate is indicated in the ‘The Z coordinate of the point is (mm)” box.

IX. OPERATING THE CMM

CMM connections
- The Block diagram of system is delivered.
- The adapter is coupled to AC power supply and the point provided on the circuit board.
- The RS-232 cable is connected to the consistent port on the CMM circuit board and the PC.
- The power to system is switched on using the ON/OFF switch present on the circuit board.

Steps:
1. Open the exe file of program. The screen performs.
2. Start the program from the drop down menu in the tool bar at the top corner.
3. Click on the ‘Reset axis’ button. This will move the CMM to its home position.
4. Enter the desired tenets of X and Y in the box corresponding to the ‘X=’ and ‘Y=’ respectively.
5. Click ‘Get z coordinate’ button.
6. When the probe proximity sensor is triggered at probe is stimulated, the Z axis motor halts and the Z coordinate of that point is shown in the individual dialog box.

REFERENCES