MEASUREMENT POSITIONS SYSTEM BASED ON IMAGING INFORMATIONAL CODIFICATION OF ABSOLUTE POSITION

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Abstract. *In positioning measurement techniques are a lot of diverse methods at macro and micro scales for extracting coordinates. The image processing represents in actuality a large field of innovative new systems. The actual positioning systems included into automation equipments are based on a series of transducers that are connected directly to execution elements of mechanisms. The present idea refers to a bi-dimensional working space that need by two coordinates for positioning determination. The planar space becomes an informational support that is video interpreted by a special image processing system and this system connects the absolute coordinates of an absolute origin to all objects existing into visual field trough informational entities similar with milestone. In this paperwork the authors present the principle and some results obtained into experimental system functioning.*

Keywords: *measurement, absolute positioning, image processing, informational codification*

1. INTRODUCTION

The fabrication of micro-mechanical assemblies needs by a very accurate positioning of components in the framework. The micro-assembly order size level it indicates the interval delimited by 1 micrometer and 1 millimetre and it refers to different technical fields such as the assembly of mechanisms (micro-gears, micro-motors), the assembly of MOEMS and the assembly of optical systems (lenses for optical fibres, switches) [1,2,3,4,7,12,13].

An assembly composed by many pieces imposes a schedule of manipulations tasks, and multitude of them will be emplaced in a proximity space of joining area, being necessary in certain moments of the process. These situations necessitate accurate positioning from a place to another, components orientation relative to different local bench-marks and between them orientations. The quantifying of displacements supposes interactive measurements, coordinate's memorizing, assigning positions to different objects from work area and other same operations that need localization. The gripping represents a transfer operation between two distinct positions that can be pass by an object, usually using different type of tweezers [5,6] adapted with the application every time.

The flexibility [8,9,10] can be discussed in micro assembly technologies imagining a series of universal devices for gripping and positioning, for all operations being possible automatic execution [11]. The positioning is an essential point in micro-assembly technologies and for that reason, in this paper is presented an innovative system designed to facilitate this important function.

2. THE INNOVATION

The authors of this paper propose a codification method to determine coordinates values within a planar space. The microscopic observation will produce the capturing of images that contain precise information about "where we are" in the process framework.

This information necessitates a special "reading" method that will generate the exact coordinate's values in a certain point. A computational mechanism intercepts the images, extracts the useful coordinate information and assigns for all "in proximity" objects the corresponding position relative to an absolute coordinates system.

In this way it is possible to build an interceptive system that can determine the absolute coordinates for all objects included within planar space, being capable to store into database the "map" of involved objects.

This innovated system behaves like a coordinate's scanner that assigns for all detected objects the corresponding absolute positions.

Image processing algorithms are needed and a powerful hardware system to allow an interactive mode of working. The software optimisation becomes essential to shorten the processing periods of time and

a good synchronisation between the displacements of devices such as the tweezers or the grippers and the objects.

3. CODIFICATION OF INFORMATION

The codification means the modality to represent imagistic numerical values that refer to absolute position of certain local bench-marks.

The code is binary in this case and it is shown in figure 1.

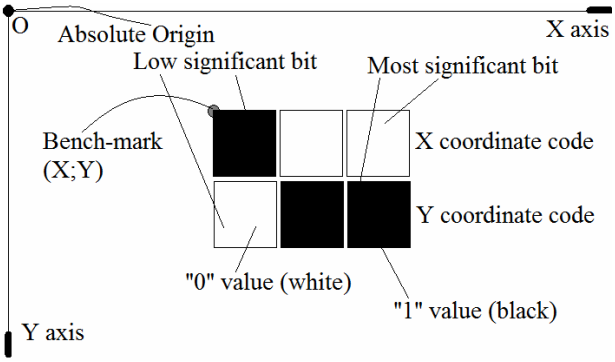

Figure 1. The binary codification

Each coordinate is a binary number represented with *n* bits (three particular value, figure 1), disposed between low significant and most significant of them. The bench-mark is assigned with the coordinates couple (X; Y) in absolute reference system XOY.

4. COORDINATIONS MEASUREMENT

For measurement of absolute coordinates, it is necessary by vectors mathematics, a simple transfer between local framework of capture and absolute reference system via coded values for benchmark coordinates.

The position of a bench-mark is a given constructive data, the video measurement focusing on determining of local objects position. In capture framework it will exists at least one benchmark, just one being sufficient. The reference point of bench-mark is the point with known absolute coordinates. The proximal detected object will be referred to this point, measuring the distances between them.

In this way the all detected objects (figure 2) into proximity of benchmark (X;Y) can be video measured relative to this locally known point, finally, using the transfer coordinates method, will obtain each of them the absolute coordinate in XOY reference system.

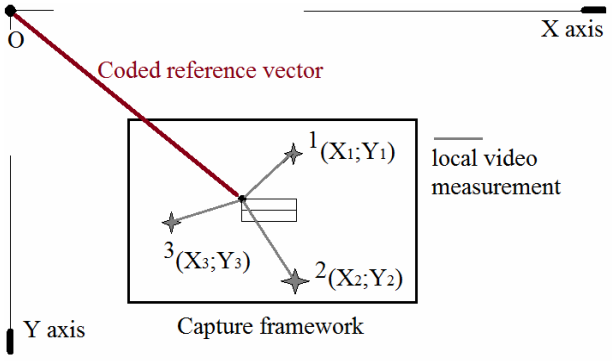

Figure 2. Coordinates transfer

The mathematic formula for coordinates transfer is presented in relation (1) and it is a sum of vectors.

$$\vec{v}_{object} = \vec{v}_{bench-mark} + \vec{v}_{video-measurement} \quad (1)$$

Discussing in coordinates terms, in relations (2, 3) is represented obtained absolute coordinates for one detected object.

$$x_{object} = x_{bench-mark} + x_{video-measurement} \quad (2)$$

$$y_{object} = y_{bench-mark} + y_{video-measurement} \quad (3)$$

So you can see, the model is very simple and the effects are major. It becomes evidently that the limits of entire planar space are not important, the systems having the capacity to code large areas relative to capture framework.

5. RESULTS. CONCLUSION.

In figure 3 is presented a capture of working software which includes a bench-mark and 4 different objects. As it's shown, the coded coordinates generated couple [3,3].

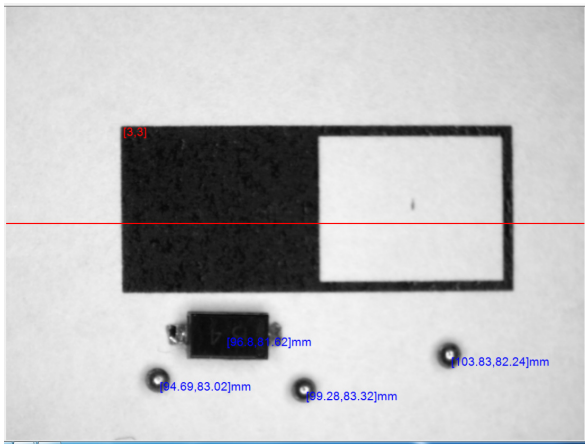

Figure 3. Experimental results

These values are multiplied with specific constructive constants of axes OX and OY, generating

the absolute coordinates of specific point of bench-mark.

The objects (four in this case) are resolved each of them, with its absolute coordinates, conform to shown image.

The main conclusion is that the idea is available, remaining to minimize the dimensions of working space. The miniaturizing will introduce this system into micro world, the principle being exactly the same.

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