



Deliverable Report

Client : European Commission

Project : FRESH

Project N°: FP6-516059

Project Number: FP6-516059
Document number: DR_FRESH_WP2.5.
Document Title: Final report
Availability: Confidential

Abstract **This report summarizes the work done on integration with CAD/CAM Tools of the Fresh WP2**

Keyword List WP2, integration with CAD/CAM Tools
From paper document to CAD method



Deliverable Report

Client : European Commission

Project : FRESH

Project N°: FP6-516059

FROM PAPER DOCUMENT TO CAD METHOD

1. INTRODUCTION	3
2. FROM SEGMENTATION TO CAD	3
2.1. SEGMENTATION ENVIRONNEMENT :	3
2.2. CAD ENVIRONNEMENT :	3
3. GRID CALCULATION	4
3.1. LISTING OF ALL THE POSITIONS BEFORE EXPORT TO DAO	4
3.2. TRANSFORMATION TO DAO GRID SPECIFICATION	4
4. SCALE TRANSFORMATION	5
5. FONTS DETERMINATION	6
6. CONCLUSION.....	6



Deliverable Report

Client : European Commission

Project : FRESH

Project N°: FP6-516059

1. INTRODUCTION

The complete process includes numerisation up to CAD objects Handling.

Between these steps, some different objects classes must be defined to realize the gradual change of the numerical information from the paper document to the schematic CAD file.

All the basics objects need some specific properties and methods to define their size, orientation, depth, etc. They are create and used by the image segmentation tools.

The following step is the characters recognition, which produces other classes of objects like character, word etc. Finally, all these objects must be transmitted to the CAD tools.

When the conversion step to pass from segmentation to CAD environnement is done, it is necessary to process a grid calculation to obtain alignements and connexions accuracy.

In segmentation environnement, their extracted shapes are almost always different. A few pixels are enough to modify the connexion positions.

When a paper document must be numerised, the operator can select the size of the pixels.

In DAO environnement, the pixel size is 0.1 millimeters. If we want to obtain a DAO drawing which have the same size than the paper document, two solutions are available.

- The document is numerised with 254 DPI. This value is equal to 1 pixel per 0.1millimeters.
- The pixels size is different than 0.1millimeters and the export process must apply a scale transformation.

2. FROM SEGMENTATION TO CAD

2.1. SEGMENTATION ENVIRONNEMENT:

First the document is digitized. The basic information format is the bitmap, regardless of the source file format.

The main information extracted from the bitmap is only the block of connected pixels.

Each segmentation tool according to its specific functions include the blocks to more complex objects like segment, character, text or symbol.

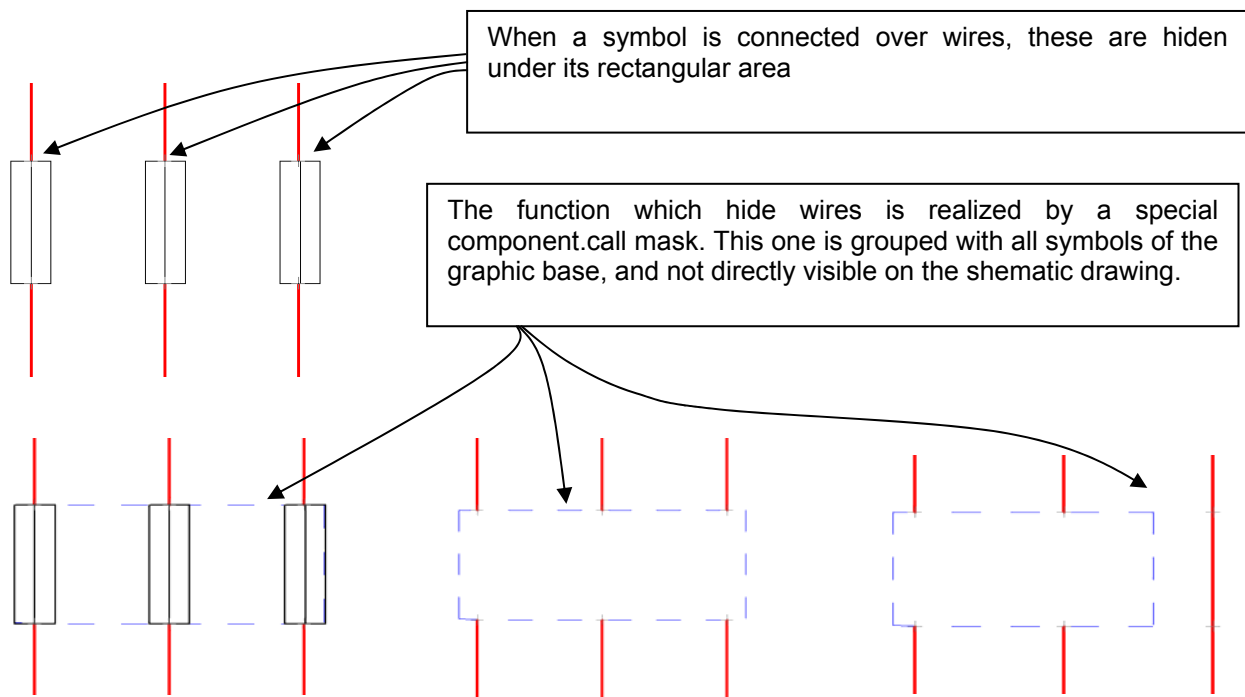
2.2. CAD ENVIRONNEMENT :

At this step of the process all the different objects must have some graphics properties, not necessary in segmentation environnement.

An object must be modifiable: moved, resized, rotated etc..

Special objects, invisibles in segmentation environnement must be created to complete the graphic behavior of the visibles blocks.

For example the mask which cut a wire when a symbol is connected over it.



3. GRID CALCULATION

3.1. LISTING OF ALL THE POSITIONS BEFORE EXPORT TO DAO

Once ready to be generated, into CAD-Drawing, all the diagram connections are calculated. When setting on grid, certain elements will have to follow the grid steps, others will have to keep a distance relative to the first ones.

The wires detected in segmentation step give all the reference positions which will be changed to the export grid values.

Each vertical wire gives a horizontal and two vertical positions. Likewise, each horizontal wire gives a vertical and two horizontal positions.

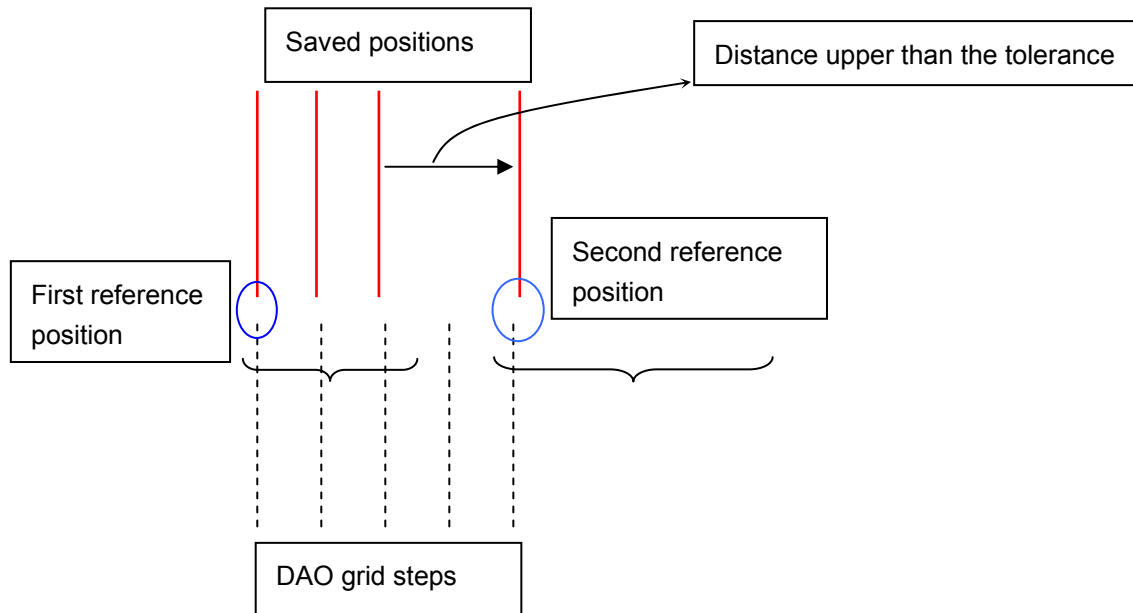
All these informations are sorted by increasing order and saved before conversion.

3.2. TRANSFORMATION TO DAO GRID SPECIFICATION

Horizontal and vertical conversions are realized independently.

The first value to convert will be the reference position for all the next which are to a distance lower than a calculated tolerance around the DAO grid step.

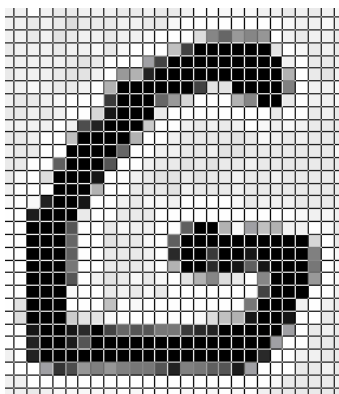
The first value which is to a distance upper than the current tolerance becomes the reference position for the next, and so on until all the positions saved are converted.



When all the positions are converted, they are affected to the symbols anchorage points.

4. SCALE TRANSFORMATION

When digitalizing a document, the operator can choose to optimize the size or the quality of the file obtained. The image size will be more important, processing longer and more expensive in machine resources.



254 dpi ; 32KO



600 dpi ; 182KO

Moreover, when exporting towards CAD-Drawing, the size of the diagram folio can be variable



Deliverable Report

Client : European Commission

Project : FRESH

Project N°: FP6-516059

For each object, a calculation process must be defined for its new anchorage points and sizing rectangle.

This process must be apply after the segmentation or after the recognition, and before the grid positioning.

5. FONTS DETERMINATION

When a symbol is recognized, the texts corresponding to its parameters are automatically generated when the symbol is placed. The coefficients and shifts allocated to the symbol are automatically transferred on its parameters.

The list of the available and usable fonts for a precise folder is reachable from the recognition module.

The texts recognized are then analyzed, blocks extracted from the image and words aspect.

The font available, the more similar in size term, will be allocated to each family.

6. CONCLUSION

The works of the differents partners of this workpackage are integrated in Algotech software. The user can numerize, cleanup the image and remove background texture by applying an adaptative thresholding algorithm. The segmentation tools segment the image into three main families, the segments, the text and the symbols. The text and the symbols are recognized and all the created data are built into DAO environnement.