SOFTWARE LIBRARY & STAND-ALONE TOOLS FOR 360 OPTICS SETUPS

360LIB Suite

INSTALLATION MANUAL,
GUI REFERENCE AND
SETUP PROCEDURE

V 2.7 - eng

INDEX

1 • GENERAL INFORMATION

1.1 Description

360LIB Suite is a C++ based computer vision software designed to optimize the optical performances of 360° optics setup, as the ones typically used for single camera, lateral inspection purposes. With the use of both a .dll library and dedicated stand-alone tools, it makes it easy to take care of all the aspects of a typical 360° optics setup (correction of decentering and unwrapping) which, if not properly addressed, can affect negatively the results of the inspection, such as OCR/OCV/barcode reading.

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1.3 Installation instructions

When a license is purchased, a short URL for the download of the software will be contained in the License Key packaging.

The downloaded file is a compressed zip containing this manual and the setup executable. In order to install, double-click on the setup file, insert your administrator credentials and follow the on-screen wizard.

During installation, the user will be prompted for the installation of Visual C++ Redistributable runtime. If the user is sure that this component is already installed in the PC, it is possible to cancel the runtime installation. In any other case, the runtime is strictly needed for the execution.

The installer installs the software in the PC, creates a start menu shortcut to the 360LIB APP executable and prepares the environment for the integration of the library in your code.

In particular, two environmental variables are created:
- 360LIB_LIB: path to the .lib files for binaries reference.
- 360LIB_INCLUDE: path to the library header files.

For the deployment of a software that integrates the 360LIB it is necessary to operate a fresh installation of the 360LIB Suite on every machine that will be built. Doing so will install and add to the system PATH the needed DLL binaries for runtime execution.

During installation both release and debug builds of the library are installed. The libraries with the "_d" suffix are debug builds.

1.4 Minimum requirements

360LIB Suite requires a Windows based PC with the following:

- Intel® Core™ i3 Dual Core (4th gen) or AMD Ryzen™ 3 Processor (*Minimum*)
- Intel® Core™ i5 Quad Core (4th gen) or AMD Ryzen™ 5 Processor (*Recommended*)
- Windows 10 64 bit or later
- Color WXGA-H monitor (1280 x 720 resolution)
- 4GB (*or more*) RAM
- At least 150MB free hard disk space (*for installation*)
- An internet connection (*for installation download*)
- Available USB port (*for USB License Dongle*)
- Visual C++ runtime version 2015 or later
- .NET framework 4.5.2 or later
- Administrative privileges (*for installation*)

For the development of software using the 360LIB Suite Visual Studio 2015 is highly recommended. The installation of OpenCV 3.4.0 or higher is also needed. In order to use 360LIB Suite, an explicit reference to the core header of OpenCV library is needed (see example at section 2.2 of this manual).

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> **NOTE:** *Although the software is designed to work with the Windows Operating Systems listed above,* ***Opto Engineering S.p.A.*** *cannot guarantee operation on OSs no longer supported by Microsoft Support Life Cycle Policy.)*

360LIB APP is a full GenTL compliant software. Any GenTL compliant camera device can be used with this software. Camera manufacturer drivers need anyway to be installed in order for the program to operate correctly.

2 • 360LIB REFERENCE

2.1 Interactive documentation

The installer copies library documentation in the *doc* folder inside the installation directory. Open *index.html* file in a web browser for interactive documentation.

Web-based documentation contains information regarding:
- the integration of the library
- classes, structures and function signatures necessary provided from the software library.

2.2 Application example in C++

```cpp
#include "IUnwrapper.h"

int main(int argc, char** argv)
{
        OELib::Unwrapper unw = OELib::IUnwrapper::Create();
        //Load from File
        OELib::ImagePtr srcImage = OELib::ImageFactory::load("test.bmp");
        OELib::ImagePtr outImge;
        /*
                - Template1
                - Template2
                - Searching Area

                Template parameters:
                - 2% Radius Tolerance
                - 50 px circle shift
        */
        OELib::Circle c1 = OELib::Circle(1260,1044,300);
        OELib::Circle c2 = OELib::Circle(1248, 1044, 600);
        OELib::Circle searchArea = OELib::Circle(1260, 1044, 150);
        unw->SetRadiusTolerance(2);
        unw->SetMaxOutCenter(50);
        unw->SetFirstTemplate(srcImage, c1);
        unw->SetSecondTemplate(srcImage, c2);

        /*
                - 2% Radius Tolerance
                - Check Area Stability1 4 px and Check Area Stability2 4 px
        */
        unw->SetSearchingArea(searchArea,4,4);

        //set OutputImage Size
        unw->SetUnwrapImgResolution(1500,500);

        //Unwrap!
        outImge=unw->Unwrap(srcImage);
}
```

This example code requires OpenCV library for image loading and saving. Ensure that the library is linked to your project to use this example as-is.

> **NOTE:** *The libraries of the Lib360 are native C++ dynamic libraries and as such they are fully based on unmanaged code. In order to use it in .NET based applications, a wrapper implementation is needed. A Dynamic-link library wrapper (ManagedLib360.dll) is located in bin/ subfolder.*
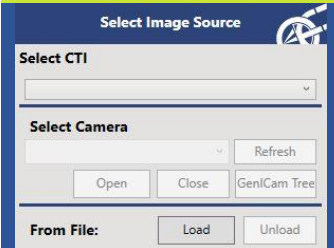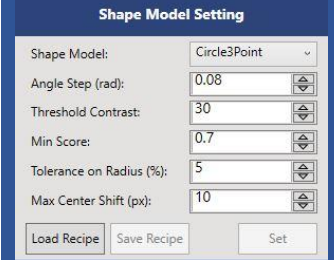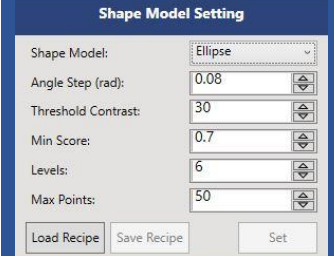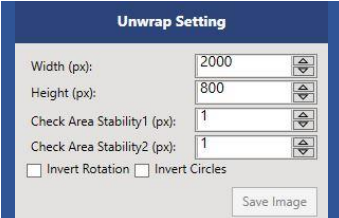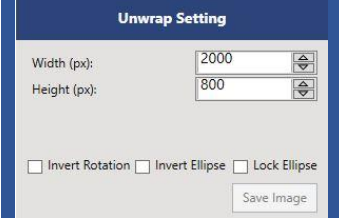
3 • 360LIB-APP

3.1 General overview

The 360LIB APP is a full featured deploy of the 360LIB. It works both as a demo tool and as a quick start tool for setting procedure. All functions in the 360LIB-APP are available in the 360LIB library.

Figure 1

3.2 Control Panels

Panel	Title	Description
	Image Source Panel	Camera source settings: - Image from camera - Image from file
	Model and Input parameters Panel (Circle Model)	- **Shape Model Setting**: it defines parameters used in template definition
	Model and Input parameters Panel (Ellipse Model)	- **Shape Model Setting**: it defines parameters used in template definition

Unwrap Setting Width (px): 2000 Height (px): 800 Check Area Stability1 (px): 1 Check Area Stability2 (px): 1 ☐ Invert Rotation ☐ Invert Circles Save Image	Output Image and post processing parameters (Circle Model)	- **Unwrap Setting**: sets output image size and post processing parameters
Unwrap Setting Width (px): 2000 Height (px): 800 ☐ Invert Rotation ☐ Invert Ellipse ☐ Lock Ellipse Save Image	Output Image and post processing parameters (Ellipse Model)	- **Unwrap Setting**: sets output image size and post processing parameters

3.3 360LIB Procedure

3.3.1 Image Source Setup

You can choose if load an image from file or capture a stream from a Camera.
You can set camera parameters using *GenICam tree* menu.

3.3.2 Template Setup

Choose a pair of circles or ellipses that define the searching template. The circle may be set with two or three points.
Two Points: left click on image to draw the center of the circle, then adjust the radius by moving the mouse.
Three Points: left click on three points of the image to build the first circle and adjust the radius by moving the mouse cursor, then left click to confirm (Figure 2).
Ellipse: Draw at least six points on the image on your template edge (Figure 2.1).
Click on *Set* Button to confirm your selection, repeat the procedure for the second edge.
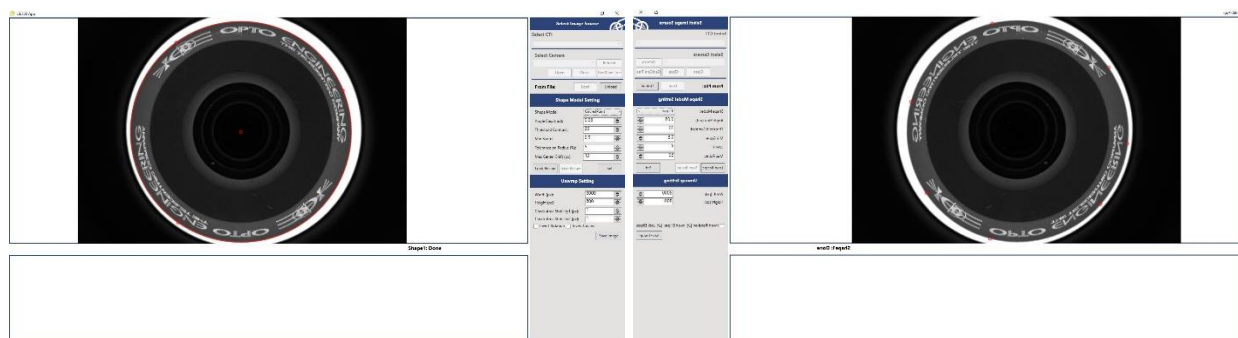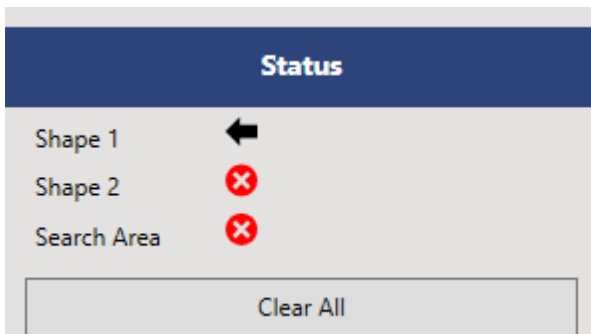

Figure 2   *Figure 2.1*

Look at the status panel, the arrow indicates where you are working, the green check marks the status completed successfully, the yellow triangle the status with errors, the X the status to be completed:

You have to create Shape 1 as explained above and press *Set*

Shape 1 created correctly, you need to create Shape2 and press *Set*

Shape2 created but with errors

All stages completed successfully

For all phases it is possible to go back by pressing the right mouse button.

Take a look at Shape Model Setting Panels:

- **Angle Step** defines the scanning step in radians to calculate the circle template model. Higher values mean less precise matching but speed up the process.
- **Threshold Contrast** defines a threshold on contrast gradient. If the calculated gradient in a point of the image is greater than the threshold value, the point will be considered as edge point.
- **Min Score** defines the minimum score for detected circles. Min score has a normalized range of value between 0 and 1 (the maximum value means perfect circle).
- **Tolerance on Radius (%)** defines the maximum variation in percentage between what you select as template and a best circle detected on the image (Only Circle Shape).
- **Max Center Shift (px)** defines the maximum center shift between what you select on image as template and a circle detected on image (Only Circle Shape).
- **Levels** defines how many pyramid levels are used for matching.
- **Max Points** defines how many points are used for matching.

After pressing *Set* button, the software will select the best templates (blue circles in Figure 3) according to parameters in Shape Model Panel.

Figure 3

3.3.3 Searching Area Setup

Click on *Search Area* button to select the maximum searching area on the image (red circle on Figure 4). Keep in mind that you are defining the maximum displacement of the circle center. Click on *Set* button to confirm your selection.

Figure 4

3.3.4 Output Image Parameters

- **Width (px)** and **Height (px)** are the size of output image.
- **Check Area Stability1 (px)** and **Check Area Stability2 (px)** prevent possible unwrapping instability of output image. Higher values produce more stable images and prevent instability caused by image noise, but excessively high values may produce inaccurate matching (only Circle Shape)
- Selecting **Invert Rotation** and **Invert Circle – Invert Ellipse** mirror the output image respectively along the vertical and the horizontal axis.
- **Lock Ellipse** parameter blocks rotation angle of internal and external ellipse at the same value. Activate this option if the edge of the object is very similar to a circumference. Disable this option if the object is deformable or/and it has a screw deformation.

3.4 Setup Test

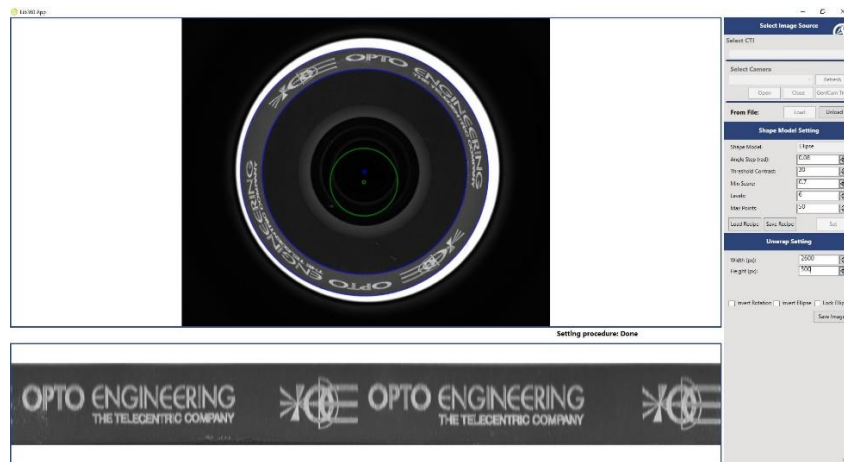At the end of setting procedure, the application shows unwrapped image (Figure 5)

Figure 5

If camera source is selected, the unwrapping function will be active for all camera frames, test the correct setup moving the object (Figure 6-7). The output image would be not influenced by object displacement (see images below).

Figure 6

Figure 7