

# Object Detection using Vision System

Murghendra Hiremath, Prof. S.A. Ghodake

Dept. of Electronics & Telecommunication Engineering (VLSI & Embedded system), Zeal College of Engineering and Research, Pune, India

**ABSTRACT:** As indicated by the Automated Imaging Association (AIA), machine vision envelops all modern and non-mechanical applications in which a blend of equipment and programming give operational direction to gadgets in the execution of their capacities dependent on the catch and preparing of pictures. Despite the fact that modern PC vision utilizes huge numbers of indistinguishable calculations and approaches from scholarly/instructive and legislative/military uses of PC vision, requirements are extraordinary.

Modern vision frameworks request more noteworthy strength, unwavering quality, and solidness contrasted and a scholarly/instructive vision framework and regularly cost considerably less than those utilized in legislative/military applications. In this manner, modern machine vision infers minimal effort, worthy exactness, high strength, high unwavering quality, and high mechanical, and temperature security.

Machine vision frameworks depend on advanced sensors ensured inside mechanical cameras with particular optics to obtain pictures, so PC equipment and programming can process, dissect, and measure different qualities for dynamic. In our framework we are utilizing Siemens PLC S7-1500 arrangement working on profinet correspondence convention for dynamic and Cognex IS7802 camera for snap ring discovery in motor gathering.

**KEYWORDS:** PLC S7-1500, Automated Imaging Association (AIA), computer vision, Object detection

## I. INTRODUCTION

Where human vision is best for subjective translation of a perplexing, unstructured scene, machine vision exceeds expectations at quantitative estimation of an organized scene due to its speed, exactness, and repeatability. For instance, on a creation line, a machine vision framework can investigate hundreds, or even thousands, of parts every moment. A machine vision framework worked around the correct camera goal and optics can undoubtedly assess object subtleties too little to even consider being seen by the natural eye.

In expelling physical contact between a test framework and the parts being tried, machine vision forestalls part harm and takes out the support time and expenses related with mileage on mechanical segments. Machine vision brings extra wellbeing and operational advantages by diminishing human contribution in an assembling procedure. In addition, it forestalls human tainting of tidy up rooms and shields human specialists from dangerous situations.

A PC is utilized for preparing the obtained pictures. This is accomplished by applying particular reason picture handling examination and order programming. Pictures are generally obtained by at least one cameras put at the scene under review. The places of the cameras are typically fixed. By and large, modern computerization frameworks are intended to investigate just known items at fixed positions. The scene is suitably lit up and organized so as to encourage the gathering of the picture highlights vital for handling and order.

## II. LITERATURE SURVEY

Machine vision gives creative arrangements toward mechanical robotization [1]. A plenty of modern exercises have profited by the use of machine vision innovation on assembling forms. These exercises incorporate, among others, sensitive hardware segment fabricating [2], quality material creation [3], metal item completing [4], glass producing [5], machine parts [6], printing items [7] and stone quality investigation [8], coordinated circuits fabricating [9] and numerous others. Machine vision innovation improves efficiency and quality administration and gives an upper hand to ventures that utilize this innovation.

Generally, visual investigation and quality control are performed by human specialists [10]. In spite of the fact that people can carry out the responsibility superior to machines much of the time, they are more slow than the machines and get drained rapidly. Besides, human specialists are hard to track down or keep up in an industry, require preparing and their aptitudes may set aside some effort to create. There are likewise cases where assessment will in general be repetitive or troublesome, in any event, for the best-prepared specialists. In specific applications, exact data must be rapidly or dully extricated and utilized. In certain situations review might be troublesome or risky. PC vision may viably supplant human investigation in such requesting cases.

A lot of known highlights, trademark for the application space, is figured, presumably with some thought for non-covering or uncorrelated highlights, so better order can be accomplished. Instances of such highlights incorporate size, position, form estimation by means of edge location and connecting, just as and surface estimations on districts. Such highlights can be processed and broke down by measurable or other figuring strategies (for example neural systems or fluffy frameworks). The arrangement of figured highlights frames the depiction of the info picture.

Model-based methodologies regularly necessitate that portrayals of the picture at various degrees of explicitness or detail be coordinated with one of conceivable numerous models of various classes of pictures. This undertaking can turn out to be troublesome and computationally concentrated if the models are perplexing and countless models must be thought of. In a top-down way to deal with model coordinating, a model may manage the age of proper picture portrayals instead of first creating the depiction and afterward endeavoring to coordinate it with a model. Another option is join top-down and base up forms. The above control methodologies are improved when one is managing two-dimensional pictures taken under controlled states of good lighting and low commotion, as it is normally the situation in modern vision applications. Picture portrayals and class models are simpler to build for this situation and complex model coordinating can be dodged. Model-based ways to deal with visual assessment assignments have been applied in an assortment of use fields.

### III. PROPOSED SYSTEM

We are using Siemens CPU 1515-2 PN and Cognex IS7802 for detecting the object. This system has two parts

- a) Siemens CPU 1515-2 PN.
- b) Cognex IS7802 vision system.

The CPU contains the operating system and executes the user program. The user program is located on the SIMATIC memory card and is processed in the work memory of the CPU. The PROFINET interfaces on the CPU allow simultaneous communication with PROFINET devices, PROFINET controllers, HMI devices, programming devices, other controllers and other systems. CPU 1515-2 PN supports operation as an IO controller and I-device.

#### IO controller

As an IO controller, CPU 1515-2 PN sends and receives data and signals from the connected IO devices within a PROFINET IO system. You can operate the CPU with a maximum of 256 IO devices, of which a maximum of 64 may be IRT (Isochronous Realtime) devices.

The CPU 1515-2 PN has the following technical properties:

#### 1) Communication:

· Interfaces

- o CPU 1515-2 PN has two PROFINET interfaces.

The 1st PROFINET interface (X1) has two ports (P1R and P2R). In addition to PROFINET basic functionality, it also supports PROFINET IO RT (Real time) and IRT (Isochronous Real time). PROFINET IO communication or real-time settings can only be configured at this interface. Port 1 and port 2 can also be used as ring ports for the configuration of redundant ring structures in Ethernet (media redundancy).

§ The 2nd PROFINET interface (X2) features a port (P1) and supports PROFINET basic functionality, which means no IO controller/IO device role. PROFINET basic functionality supports HMI communication, communication with the configuration system, communication with a higher-level network (backbone, router, Internet) and communication with another machine or automation cell.

#### 2) Integrated Web server:

· The CPU is accessible via an integrated Web server for diagnostic purposes. You can read the following information with the Web server:

- o Start page with general CPU information
- o Identification information
- o Contents of the diagnostics buffer
- o Querying module information
- o Alarms (without acknowledgment option)
- o Information about communication
- o PROFINET topology
- o Tag status

- o Watch tables
- o Memory usage
- o Data logs (if used)

5) Integrated system diagnostics:

The alarms for the system diagnostics are automatically created by the system and displayed on a PG/PC, HMI device, Web server or the integrated display. System diagnostics information is also available when the CPU is in STOP mode.

6) Integrated security:

·Know-how protection

- o The know-how protection protects user blocks against unauthorized access and modifications.

Access protection

- o Extended access protection provides high-quality protection against unauthorized configuration changes. You can use authorization levels to assign separate rights to different user groups.

Integrity protection

- o The system protects the data transferred to the CPU against manipulation. The CPU detects erroneous or manipulated engineering data.

Typically, an industrial inspection system computes information from raw images according to the following sequence of steps:

**Image acquisition:** Images containing the required information are acquired in digital form through cameras.

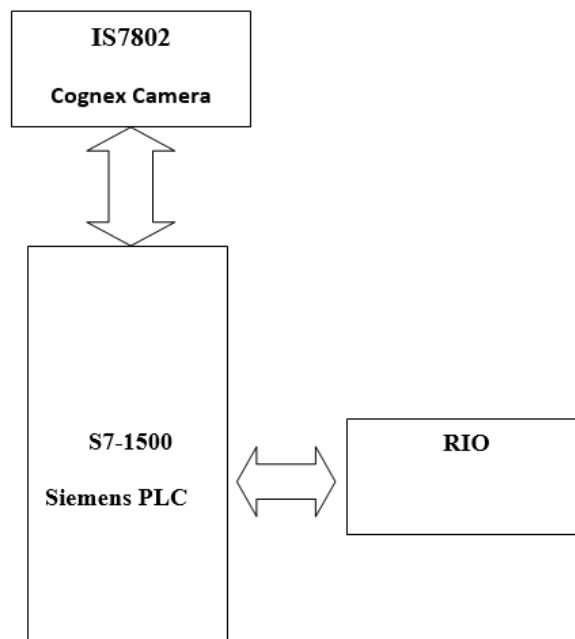


Fig. 1 Block Diagram

**Image processing:** Once pictures have been obtained, they are separated to evacuate foundation commotion or undesirable reflections from the enlightenment framework. Picture rebuilding may likewise be applied to improve picture quality by amending geometric twists presented by camera.

**Feature extraction:** A lot of known highlights, trademark for the application area, is processed, most likely with some thought for non-covering or uncorrelated highlights so better order can be accomplished. Instances of such highlights incorporate size, position, form estimation through edge recognition and connecting, just as and surface estimations on locales. Such highlights can be processed and broke down by measurable or other figuring methods (for example neural systems or fluffy frameworks). The arrangement of figured highlights shapes the depiction of the info picture.

**Decision-making:** When highlight removed is affirmed by the vision framework affirmation is sent to PLC, and afterward it takes further choice required for its framework.

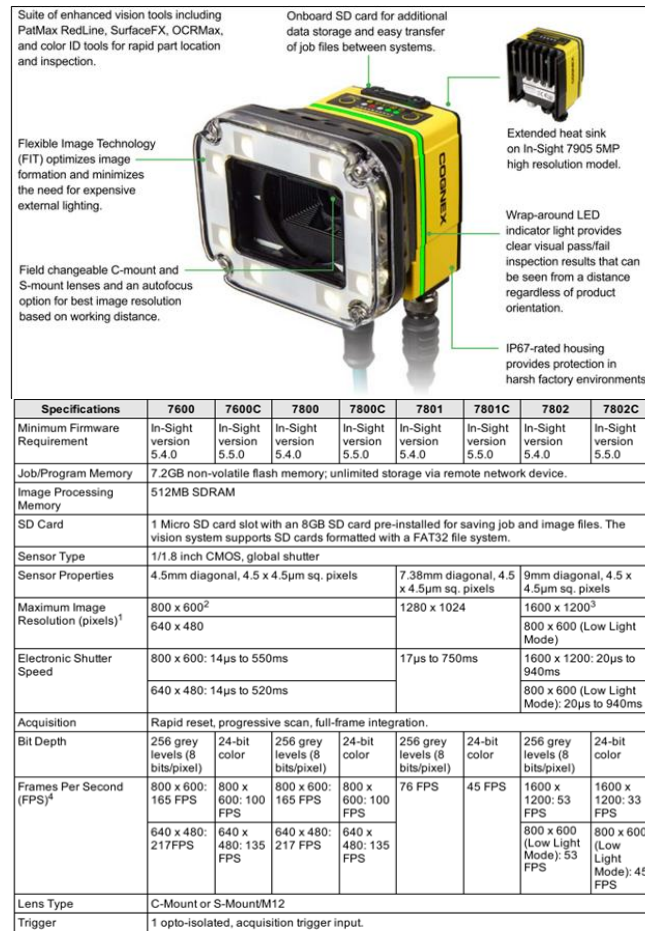


Fig.2. Camera Specification

**Algorithms**

- Step 1: Patmax pattern inbuilt feature is used in In-sight explorer software
- Step 2: Train an image in In-sight explorer software
- Step 3: Use Patmax Pattern
- Step 4: Define what pattern to be trained
- Step 5: Set threshold 50-100%
- Step 6: Then train the model
- Step 7: Result

**IV. RESULT**

As per the experiment performed and obtained results, the average value for pattern match is 83.72%, so we conclude to set a lower threshold at 70% to obtain accurate results. Any value below 70% is considered to be NOK part or there is no snap ring fitted, this concludes object detection using vision system for OK part and NOK part.

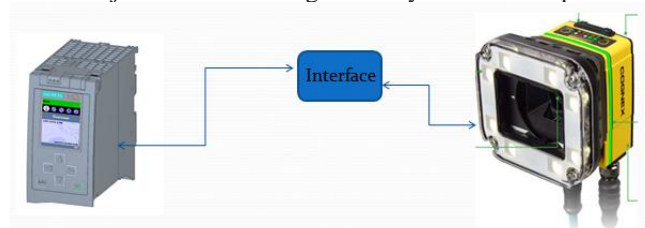


Fig. 3 Hardware Module

|                       |  | Space1 presence or absence check using Pattern matching tool |  |  |  |  |  |  |  |  |  |   |         |
|-----------------------|--|--|--|--|--|--|--|--|--|--|--|---|---------|
|                       |  | OK   |  |  |  |  |  |  |  |  |  | NOK   |         |
| Manager of OK results | 83 7022  |  |  |  |  |  |  |  |  |  |  | Manager of NOK results  | 43 7026 |
| Space1 presence       | 100%   |  |  |  |  |  |  |  |  |  |  | Space1 presence   | 0%      |
| Space1 absence        | 0%   |  |  |  |  |  |  |  |  |  |  | Space1 absence  | 100%    |
| OK                    | 100%   |  |  |  |  |  |  |  |  |  |  | NOK   | 0%      |
| Features              | Feature1 Feature2 Feature3 Feature4 Feature5 Feature6 Feature7 Feature8 Feature9 Feature10 Feature11 |  |  |  |  |  |  |  |  |  |  | Feature12 Feature13 Feature14 Feature15 Feature16 Feature17 Feature18 Feature19 Feature20 Feature21 |         |
| Setup conditions      | Unit: mm, Step: 100, Angle: 0  |  |  |  |  |  |  |  |  |  |  | Unit: mm, Step: 100, Angle: 0   |         |
| 1                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 43.55   |         |
| 2                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 3                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 4                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 5                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 6                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 7                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 8                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 9                     | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 10                    | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 11                    | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |
| 12                    | 30.95  |  |  |  |  |  |  |  |  |  |  | 30.95   |         |

Fig. 4. Space1 presence or absence check using Pattern matching tool

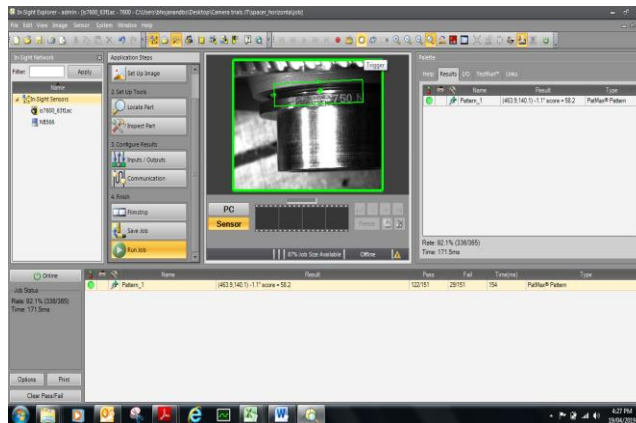


Fig. 5. Software Result Ok



Fig. 6 Software Defective Result

## V. CONCLUSION

Adapting to the growing trend of vision system, conducted experiments using vision system for object detection, here we detected snap ring in an engine assembly which is fitted on engine production line, as this is fitted manually there was no interlock possible using traditional sensors, so to overcome this limitation we used vision system to detect it accurately and hence made it possible to avoid miss out while engine production.

## REFERENCES

- [1] E. R. Davies, "Automated Visual Inspection," in Machine Vision, vol. Chapter 19, 2nd Edition ed: Academic Press, 1998, pp. 471-502.
- [2] J. L. C. Sanz and D. Petkovic, "Machine Vision Algorithm for Automated Inspection of Thin-Film Disk Heads," IEEE Trans. on PAMI, vol. 10, pp. 830-848, 1988.

- [3] C. Bahlmann, G. Heidemann, and H. Ritter, "Artificial Neural Networks for Automated Quality Control of Textile Seams," *Pattern Recognition*, vol. 32, pp. 1049-1060, 1999.
- [4] J. W. Tucker, "Inside Beverage Can Inspection: An Application from Start to Finish," presented at Proc. of the Vision '89 Conference, 1989.
- [5] A. R. Novini, "Fundamentals of Machine Vision Inspection in Metal Container Glass Manufacturing," presented at Vision '90 Conference, 1990.
- [6] J. Ker and K. Kengskool, "An Efficient Method for Inspecting Machine Parts by a Fixtureless Machine Vision System," presented at Vision '90 Conference, 1990.
- [7] T. Torres, J. M. Sebastian, R. Aracil, L. M. Jimenez, and O. Reinoso, "Automated Real-Time Visual Inspection System for High-Resolution Superimposed Printings," *Image and Vision Computing*, vol. 16, pp. 947-958, 1998.
- [8] L. Shafarenko, M. Petrou, and J. Kittler, "Automatic Watershed Segmentation of Randomly Textured Color Images," *IEEE Trans. on Image Processing*, vol. 6, pp. 1530-1543, 1997.
- H. Li and J. C. Lin, "Using Fuzzy Logic to Detect Dimple Defects of Polished Wafer Surfaces," *IEEE Transactions on Industry Applications*, vol. 30, pp. 1530-1543, 1994.
- [10] A. Mital, M. Govindaraju, and B. Subramani, "A Comparison between Manual and Hybrid Methods in Parts Inspection," *Integrated Manufacturing Systems*, vol. 9, pp. 344-349, 1998.
- [11] P. Kopardekar, A. Mital, and S. Anand, "Manual, Hybrid and Automated Inspection Literature and Current Research," *Integrated Manufacturing Systems*, vol. 4, pp. 18-29, 1993.
- [12] O. Oyeleye and E. A. Lehtihet, "A Classification Algorithm and Optimal Feature Selection Methodology for Automated Solder Joint Inspection," *Journal of Manufacturing Systems*, vol. 17, pp. 251-262, 1998.
- [13] C. Taylor, J. Graham, and D. Cooper, "System Architectures for interactive Knowledge-Based Image Interpretation," *Philosophical Transactions of the Royal Society of London (A) Mathematical and Physical Sciences*, vol. 324, pp. 457-465, 1988.
- [14] P. Baglietto, M. Maresca, M. Migliardi, and N. Zingirian, "Image Processing on High Performance RISC Systems," *Proceedings of the IEEE*, vol. 84, pp. 917-930, 1996.
- [15] M. Magee and S. Seida, "An Industrial Model-Based Computer Vision System," *Journal of Manufacturing Systems*, vol. 14, pp. 169-186, 1995.