Vision based Object Counting using Speeded Up Robust Features for Inventory Control

Nishchal K. Verma[1], Teena Sharma[1], Rahul K. Sevakula[1], and Al Salour[2]
[1]Indian Institute of Technology Kanpur, India - 208016
[2]The BOEING Company, St. Louis, MO, USA
nishchal@iitk.ac.in, tee.shar6@gmail.com, srahulk@iitk.ac.in, al.salour@boeing.com

Presented by:
Dr. Nishchal K. Verma
Associate Professor
Dept. of Electrical Engineering
Indian Institute of Technology Kanpur, India – 208016

Outline

- Introduction
- Motivation
- Goal
- Proposed Methodology
- Results
- Graphical User Interface
- Conclusion
- References

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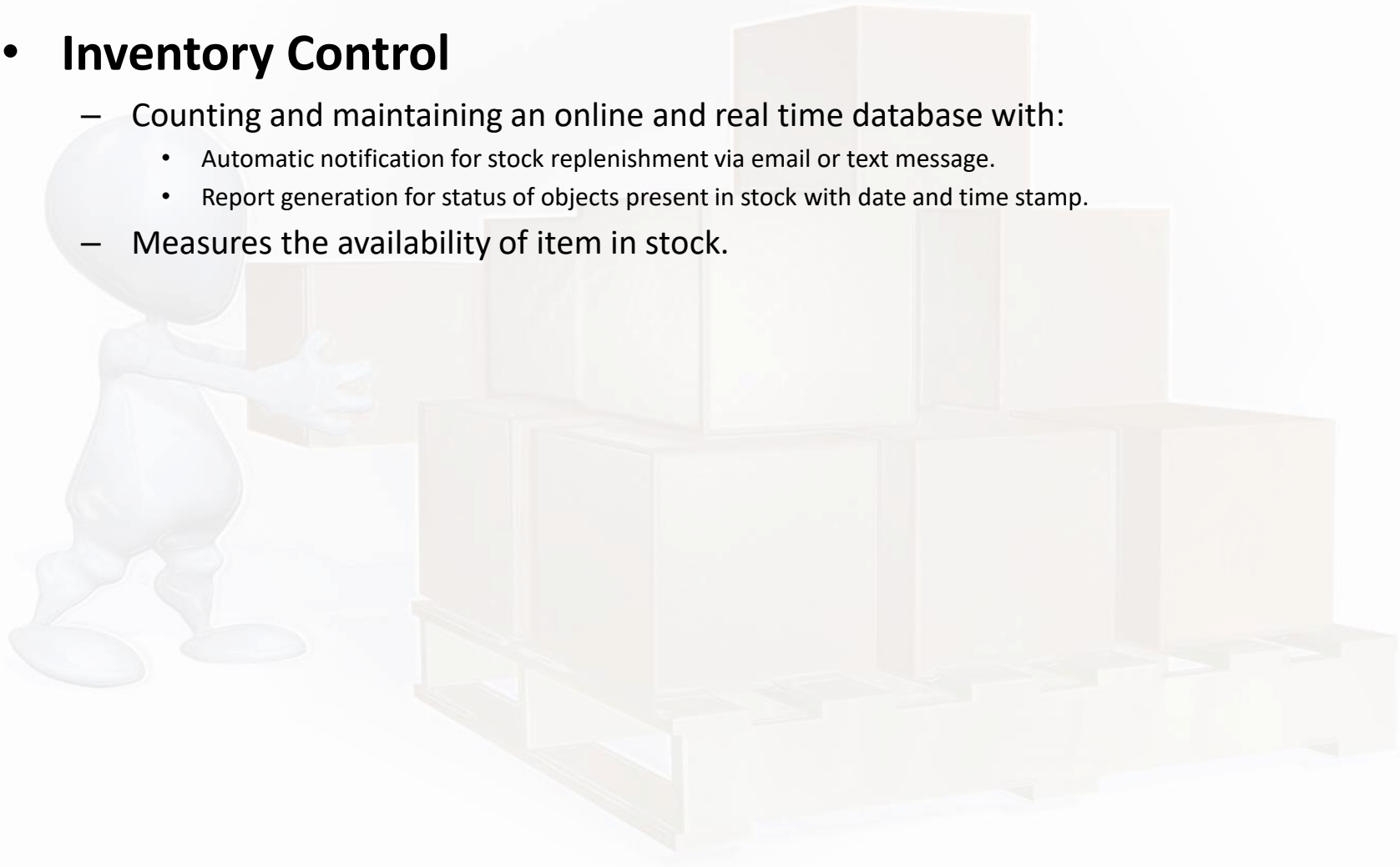
    - Automatic notification for stock replenishment via email or text message.
    - Report generation for status of objects present in stock with date and time stamp.
  - Measures the availability of item in stock.



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  - Demand and supply management in order to minimize the production cost.
  - Meeting customer requirement in a timely manner.

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Computer Vision is tomorrow's Human eye

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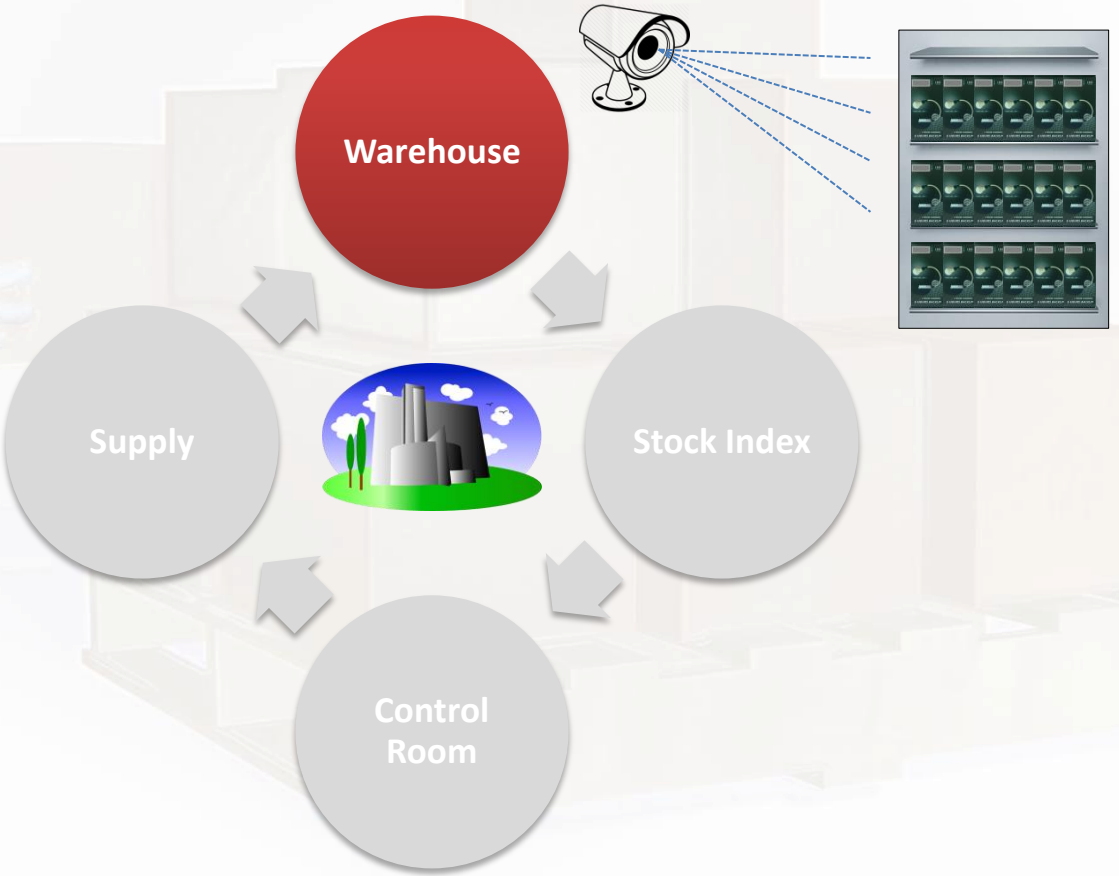

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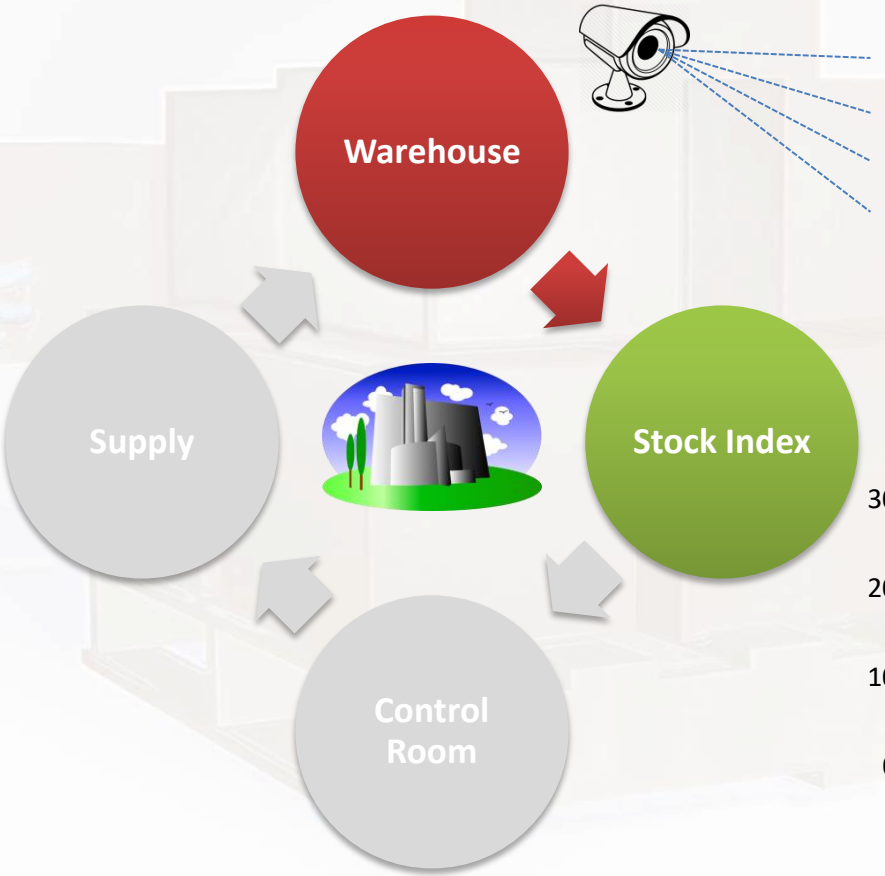
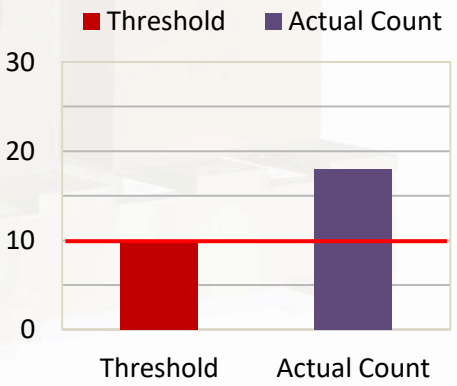


Inventory level monitoring using vision interface



Status of Inventory level

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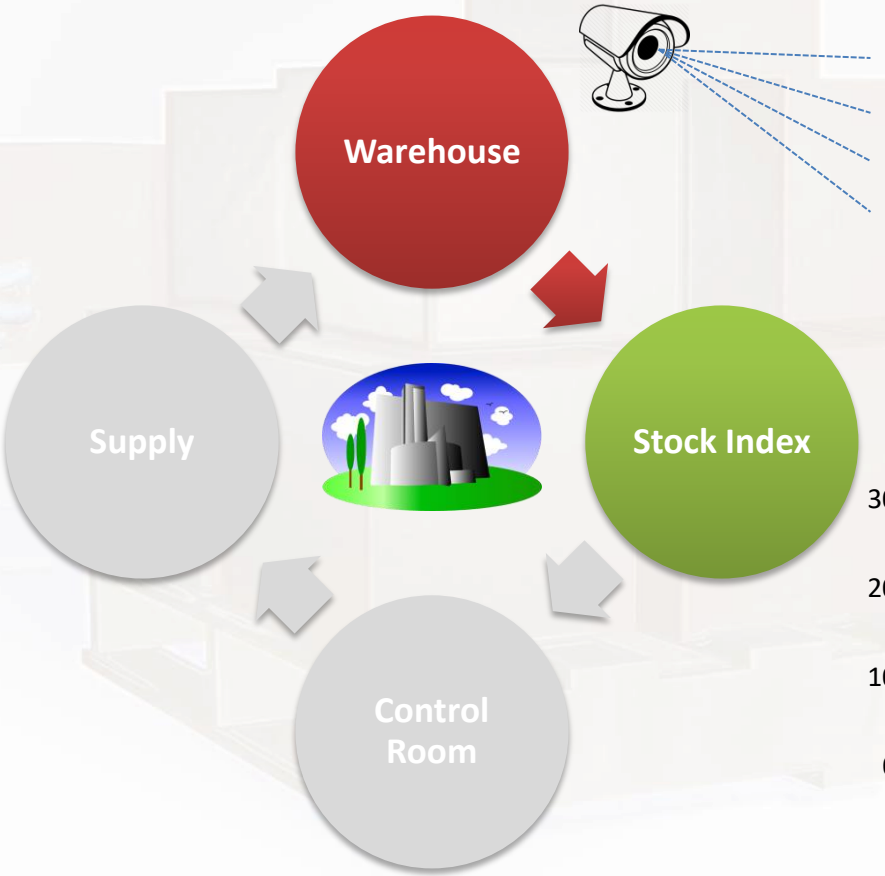

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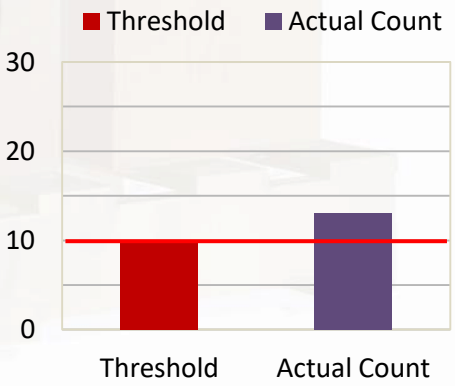

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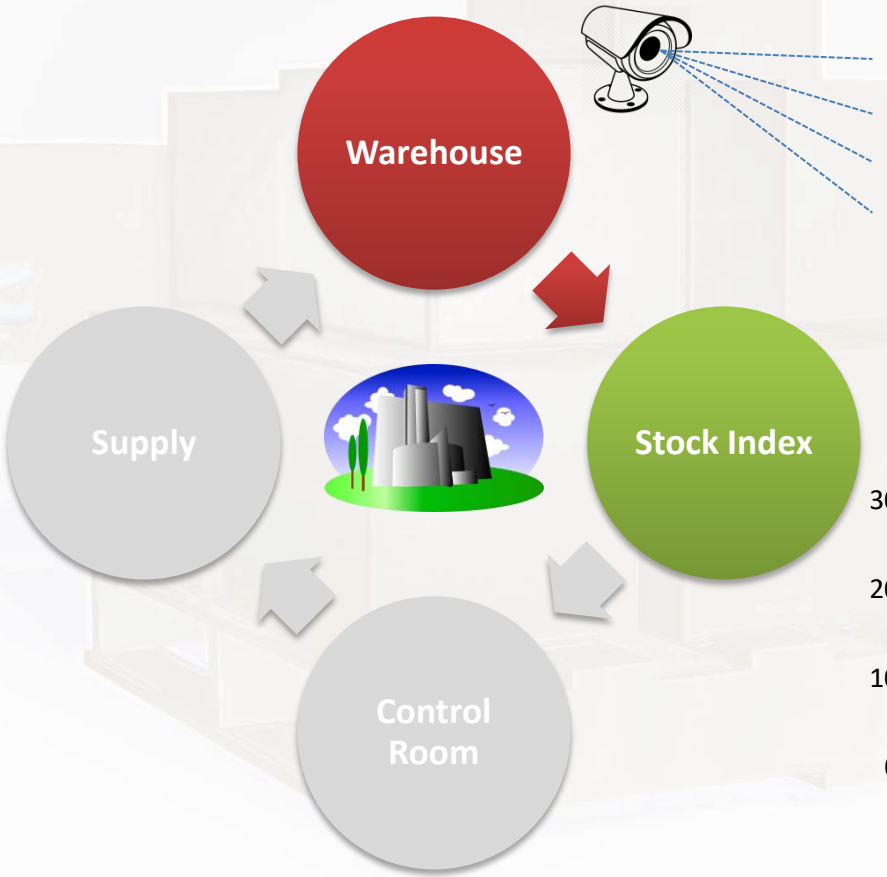

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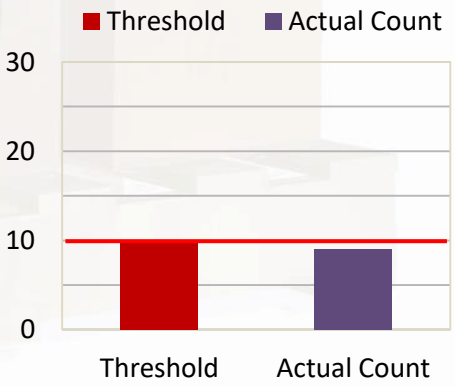

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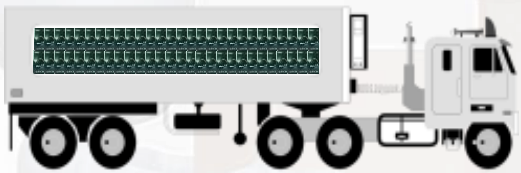
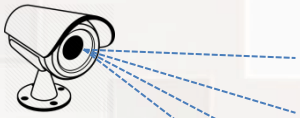
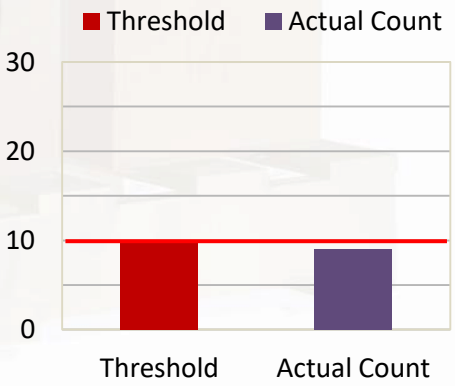


Object replenishment in inventory



Inventory level monitoring using vision interface

Automatic Stock Index notification via Email or text message



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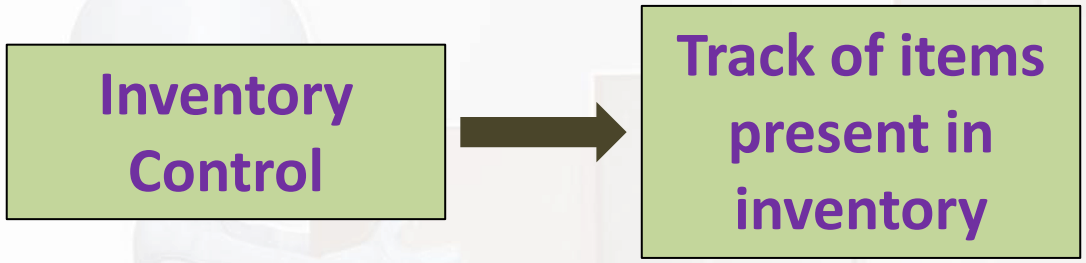

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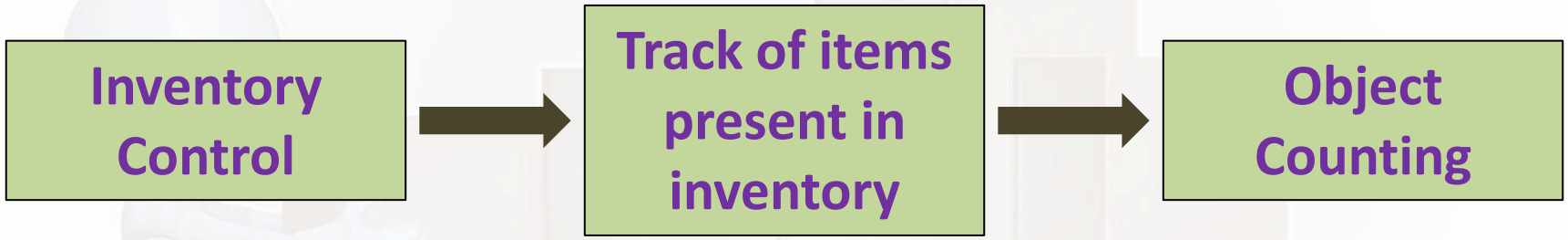

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- **Inventory control** is the process for keeping track of items present in inventory through **Object Counting**.

- **Object Counting** is the key process in **inventory control** for finding the occurrences of predefined templates of items.

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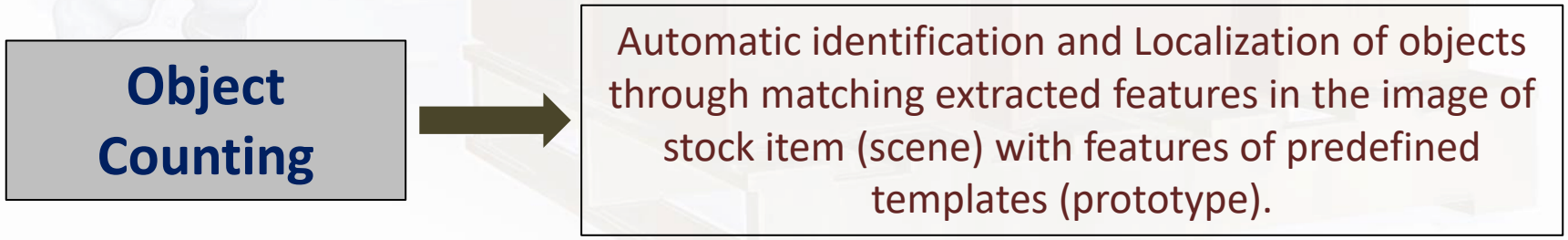

Proposed Methodology

OBJECT RECOGNITION MODEL

- Prototype and Scene Images
- SURF features of input images
- Clustering of prototype SURF features
- One to many mapping of prototype clusters on SURF features of scene image
- Clustering on mapped SURF features of scene image
- Fixing and merging of box polygons to reject false alarms
- Marking and counting of objects in scene image

Proposed Methodology

OBJECT RECOGNITION MODEL

Input Images	Feature Extraction	DBSCAN Clustering 1	Feature Mapping	DBSCAN Clustering 2	Box Formation	Counting
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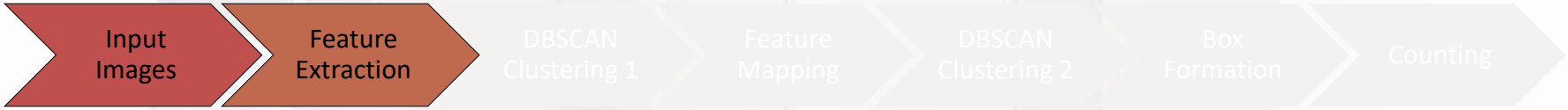
Input Images

Input Prototype Image

Input Scene Image

Proposed Methodology

OBJECT RECOGNITION MODEL



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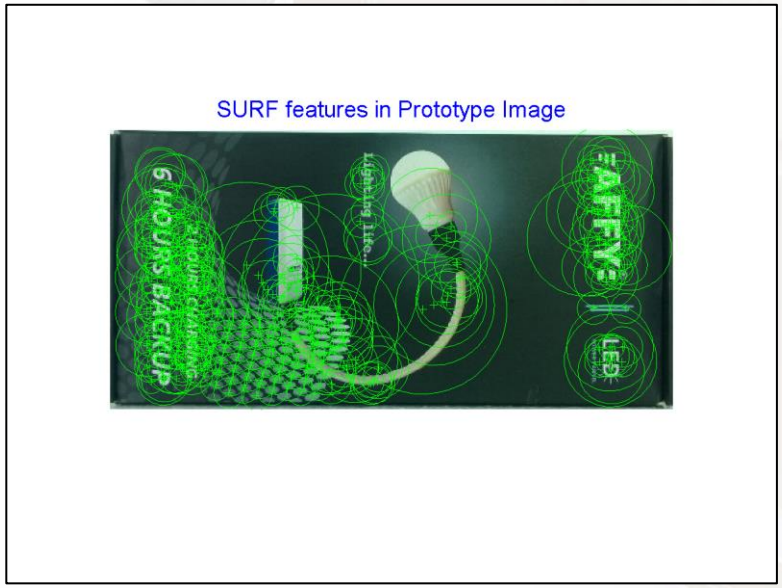
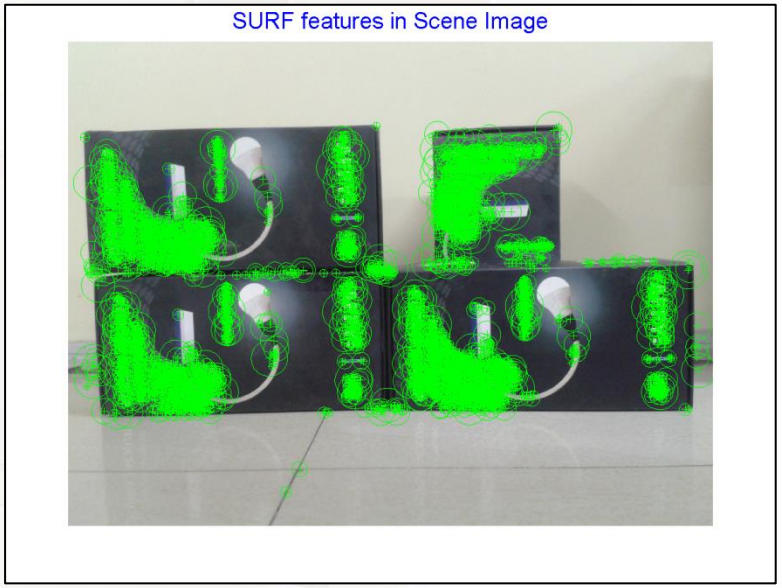
Feature Extraction

- Speeded Up Robust Features (SURF) [1] features are detected in prototype and scene image for extracting out the textural information from the image for matching.





[1]H. Bay, T. Tuytelaars, and L. V. Gool, "SURF: Speeded up robust features", *In European Conference of Computer vision – ECCV 2006. Springer Berlin Heidelberg*, pp. 404-417, 2006.

Proposed Methodology

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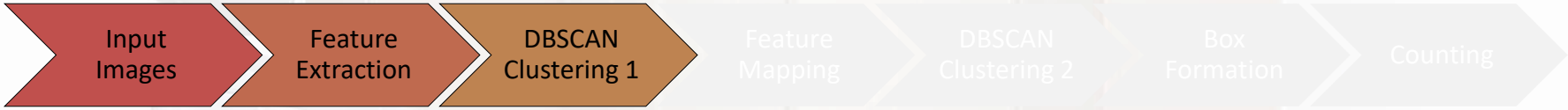

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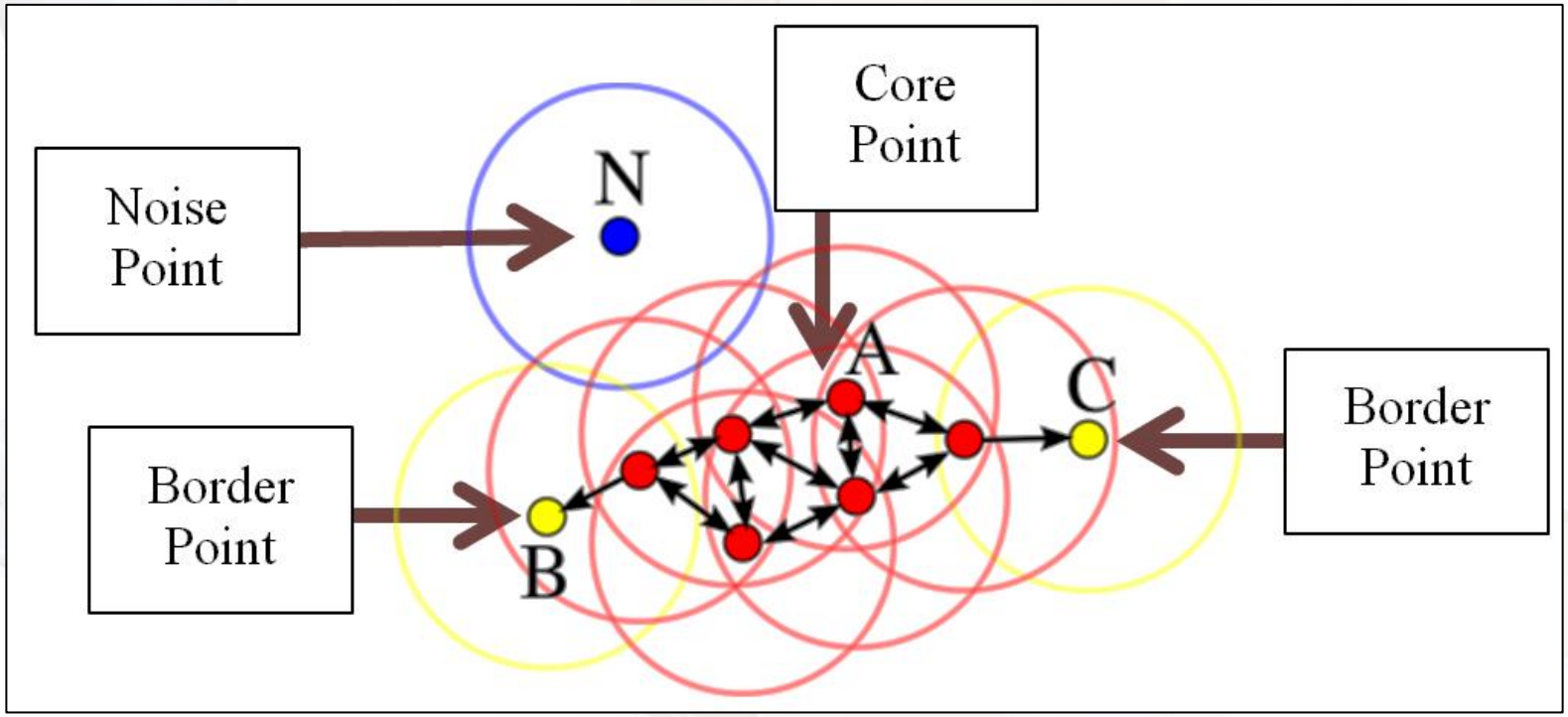
DBSCAN Clustering

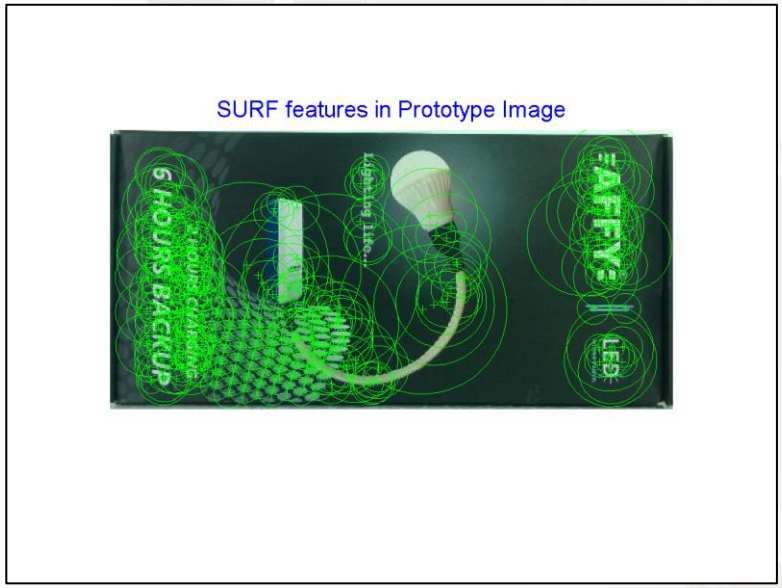
- The DBSCAN Clustering[2] algorithm separates the data points based on their density such as high density and low density region in three categories: core points (A), noise points (N) and border points (B, C).

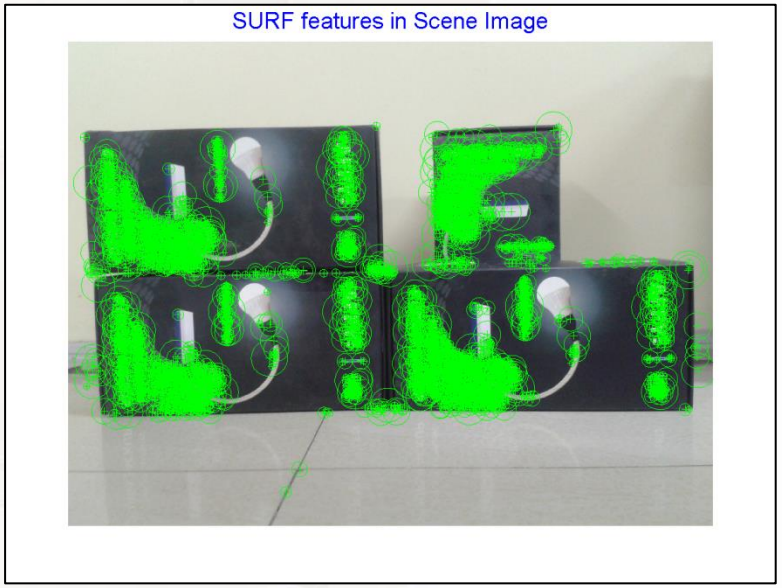


[2]M. Ester, H. P. Kriegel, J. Sander, and X. Xu, "A Density-Based Algorithm for Discovering Clusters in Large Spatial Databases with Noise", *The Second International Conference on Knowledge Discovery and Data Mining (KDD-96)*, vol. 96, no. 34, pp. 226-231, 1996.

DBSCAN Clustering in prototype

- SURF features of prototype image are clustered using DBSCAN.
- K_1: minimum number of points for clustering in prototype image.





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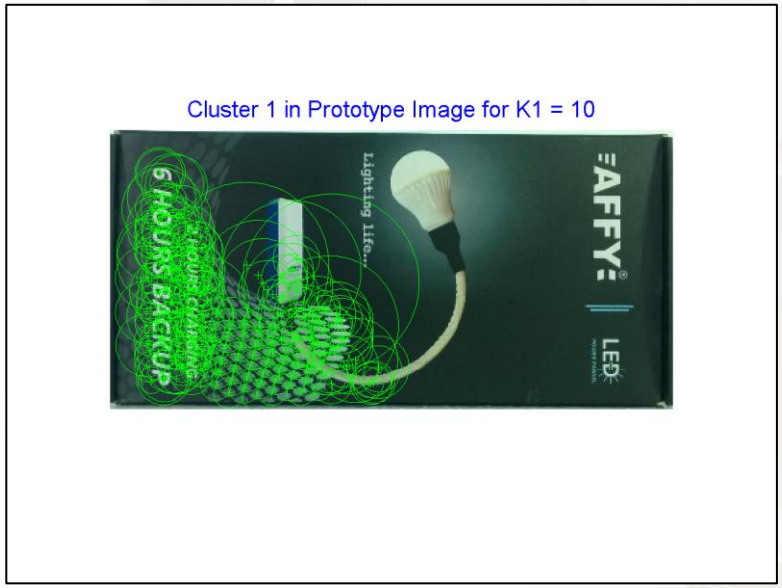

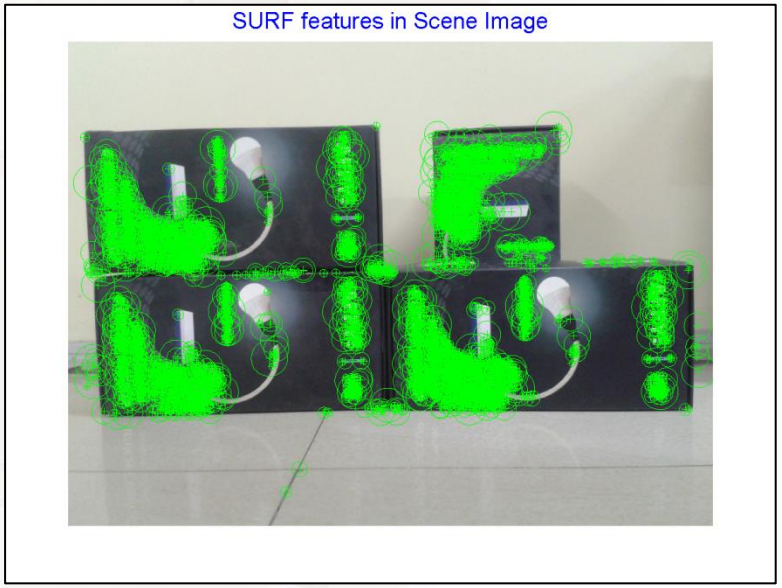

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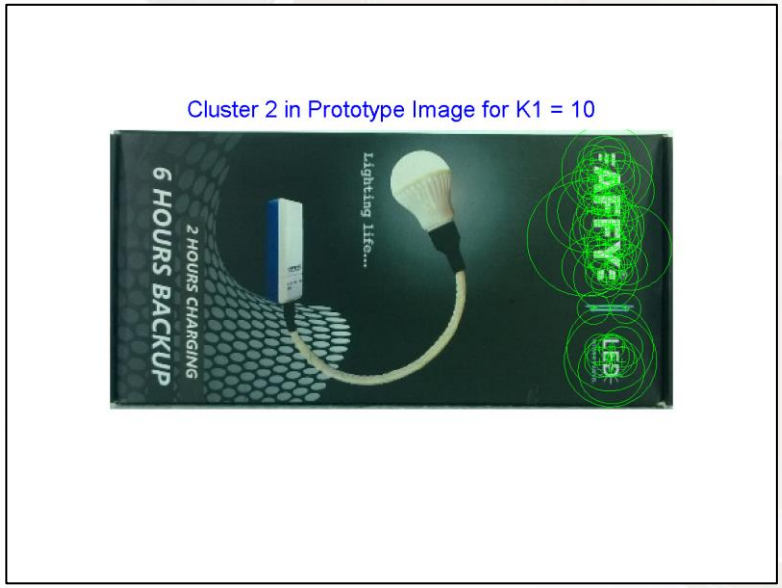

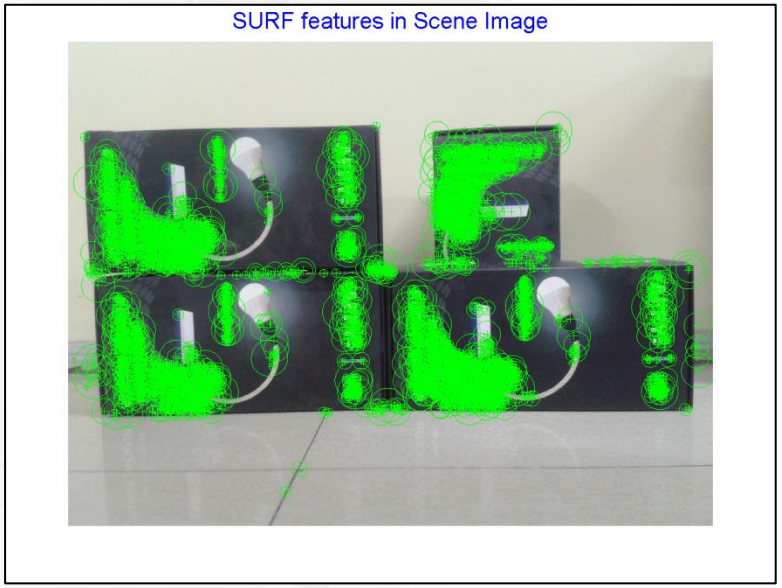

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Feature Mapping and Clustering

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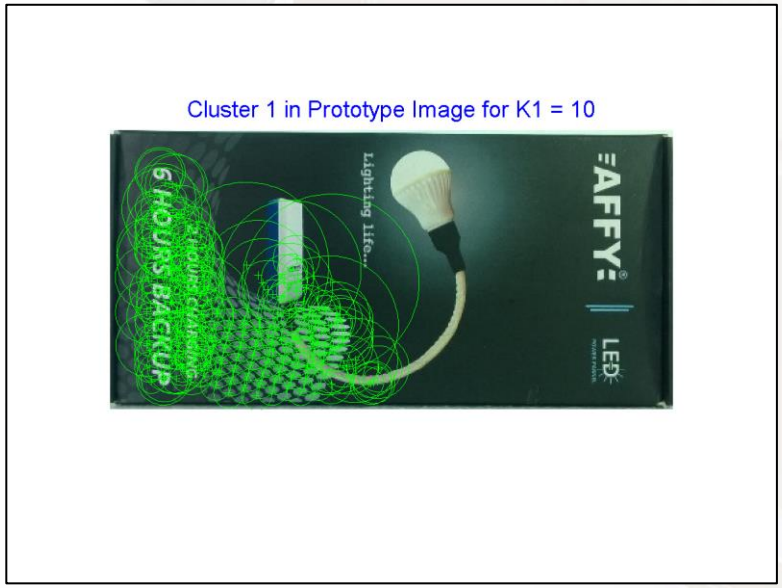
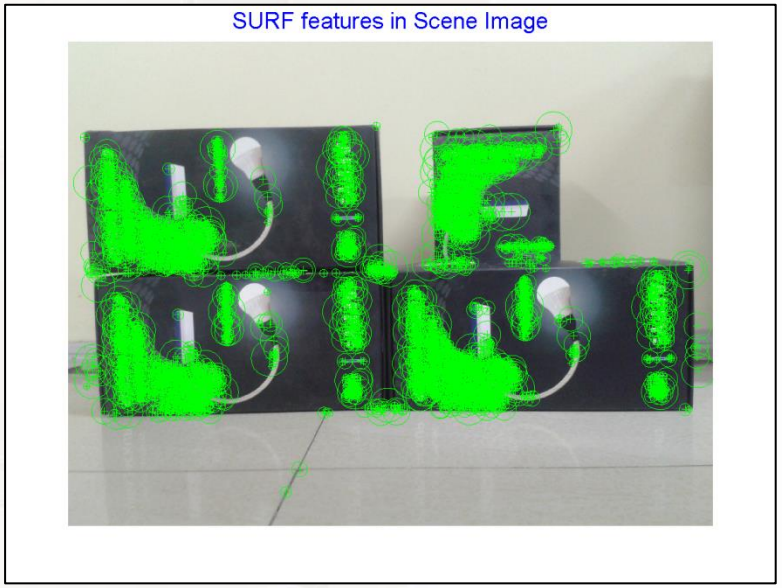
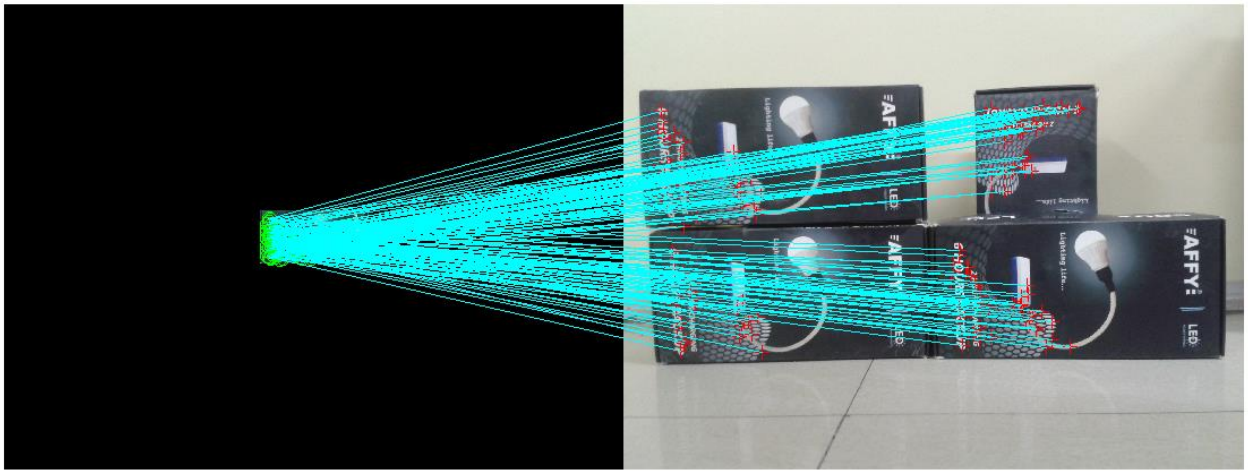




Feature Mapping and Clustering

Mapped features for Prototype Cluster 1



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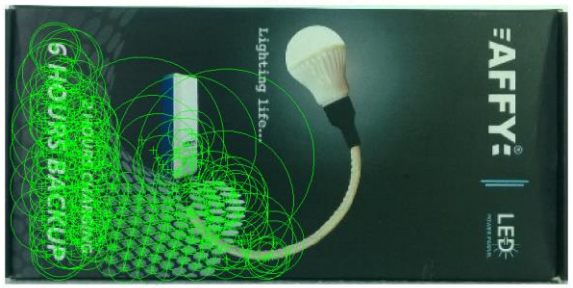
Cluster 1 in Prototype Image for K1 = 10



Cluster 1 in Scene Image

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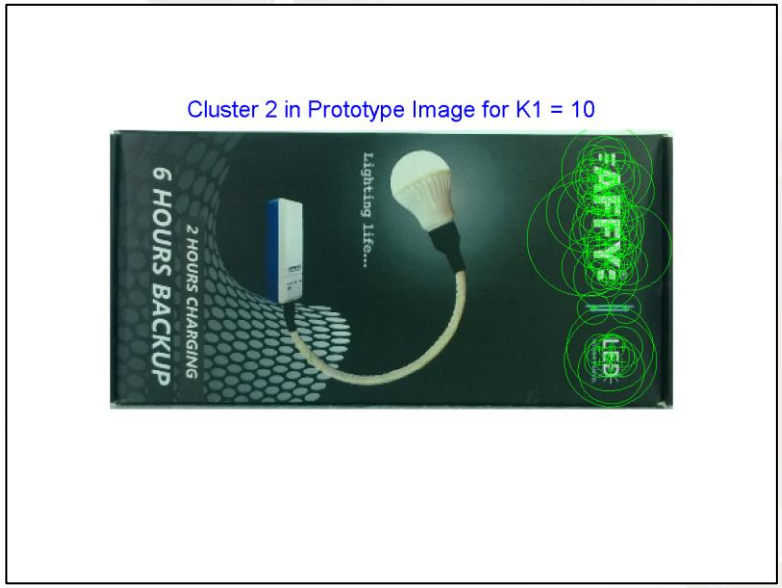
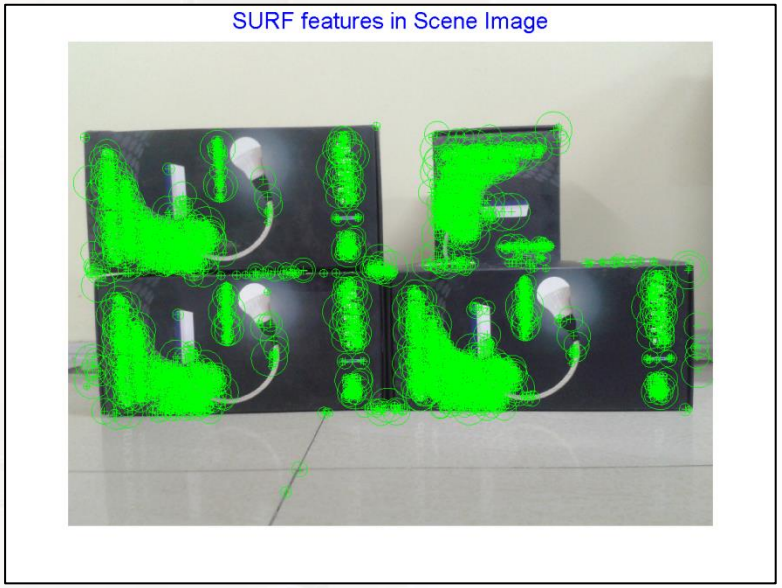
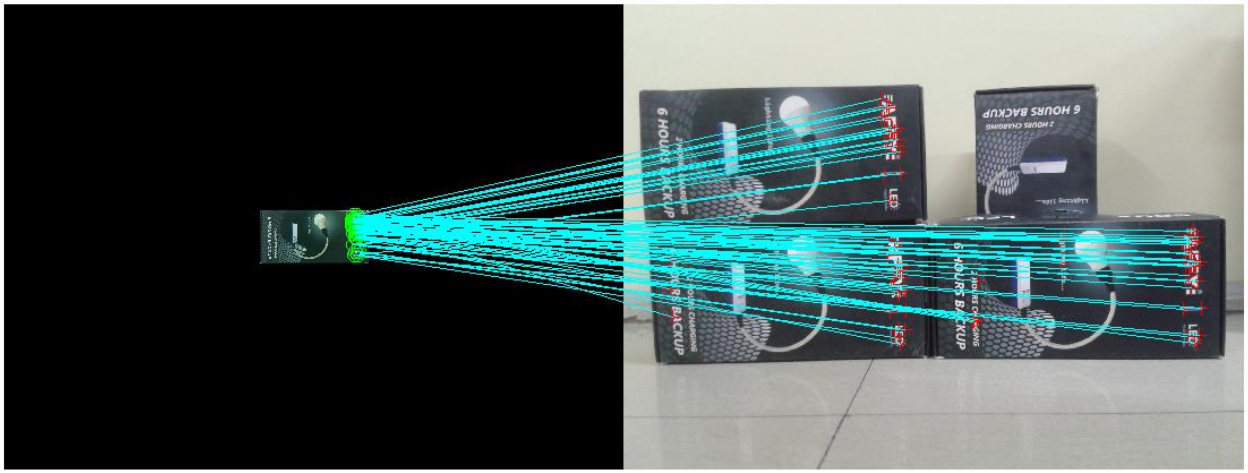




Feature Mapping and Clustering

Mapped features for Prototype Cluster 2



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Cluster 2 in Scene Image

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Box Formation

- Boxes are formed for each cluster of scene image.
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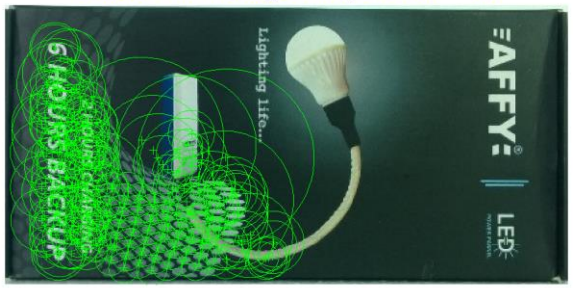

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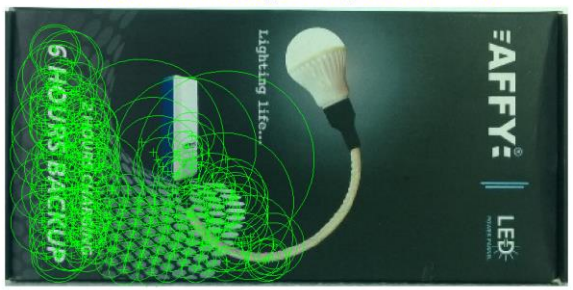

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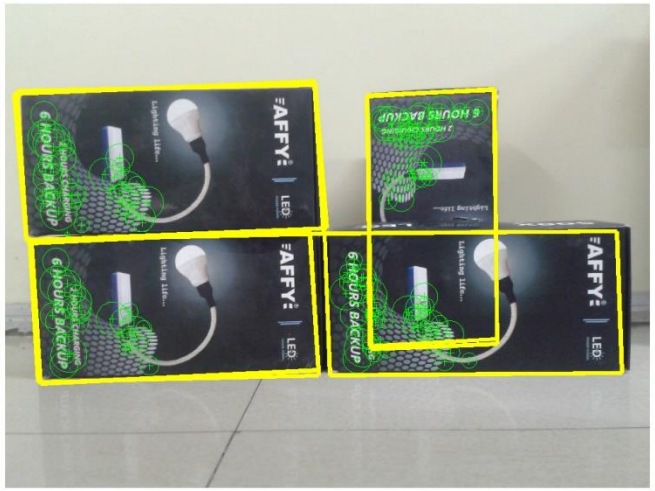

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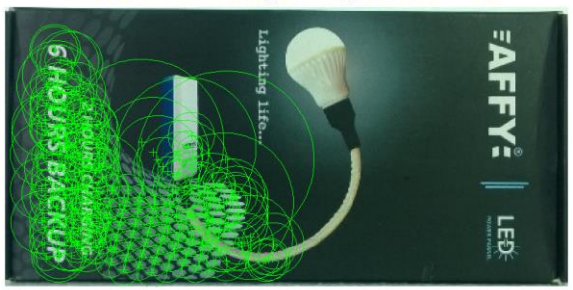

Box Formation after fixing in Scene for Cluster 1

Box Formation

- Boxes are formed for each cluster of scene image.
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Cluster 2 in Prototype Image for K1 = 10

Cluster 2 in Scene Image

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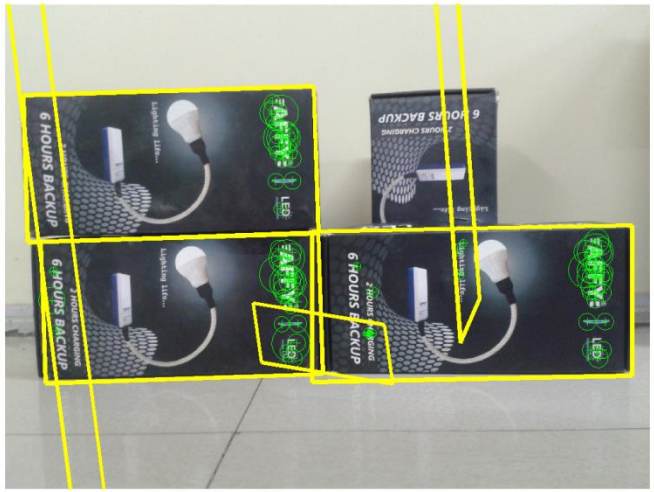
Cluster 2 in Prototype Image for K1 = 10

Box Formation in Scene for Cluster 2



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Box Formation after fixing in Scene for Cluster 2

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Counting

- After fixing more than one box can be obtained for single instance.
- All boxes are merged together to draw final box around objects in scene image.

Input Prototype Image

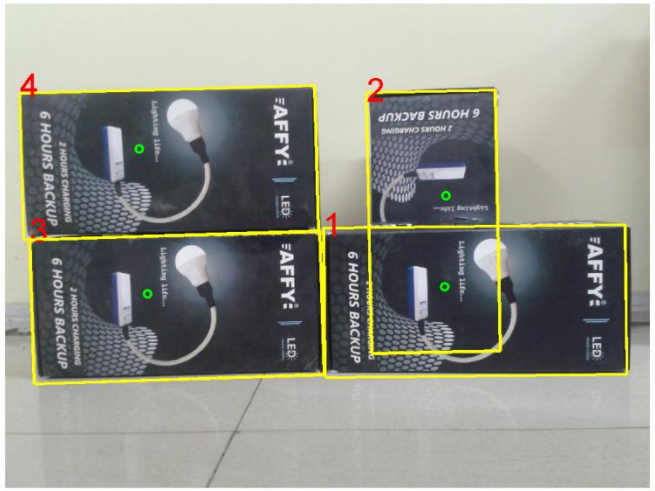
All Boxes altogether after fixing with their centroids in Scene Image

Counting

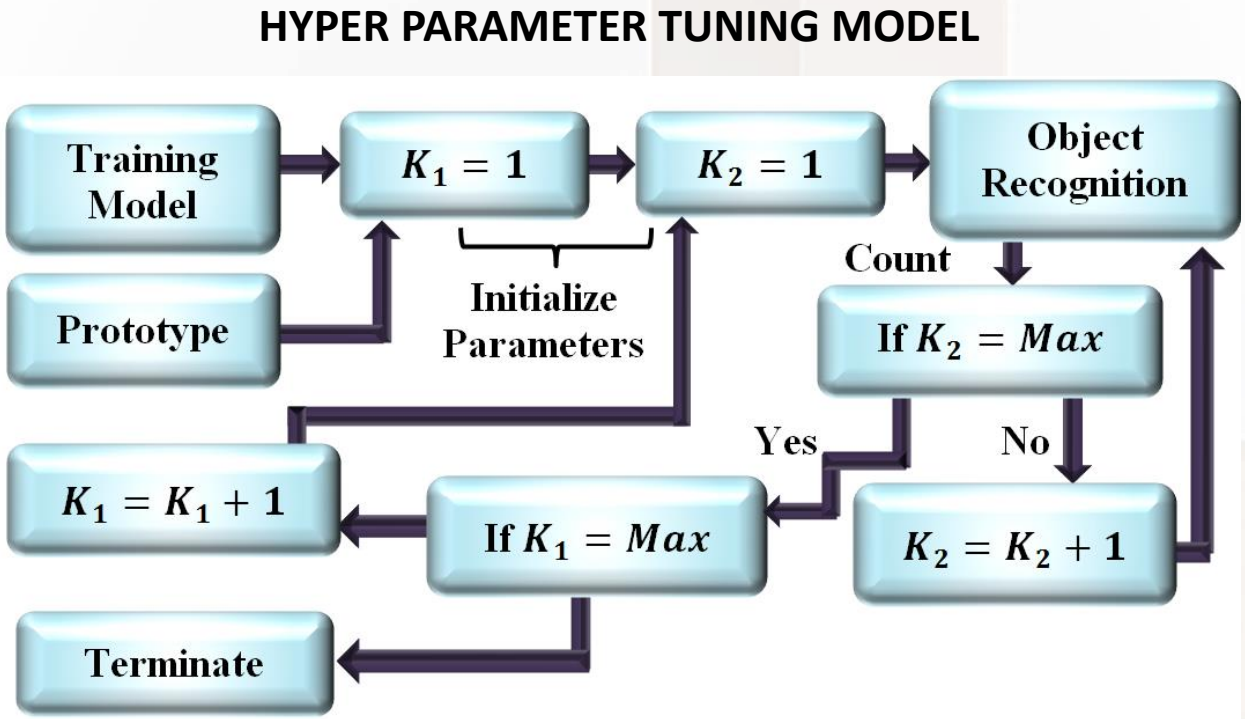
- After fixing more than one box can be obtained for single instance.
- All boxes are merged together to draw final box around objects in scene image.

Input Prototype Image

Final Boxes after merging in Scene Image



Proposed Methodology



K_1: minimum number of points for clustering in prototype image

K_2: minimum number of points for clustering in scene image

Training Model: Sample images of scene with different backgrounds

Outline

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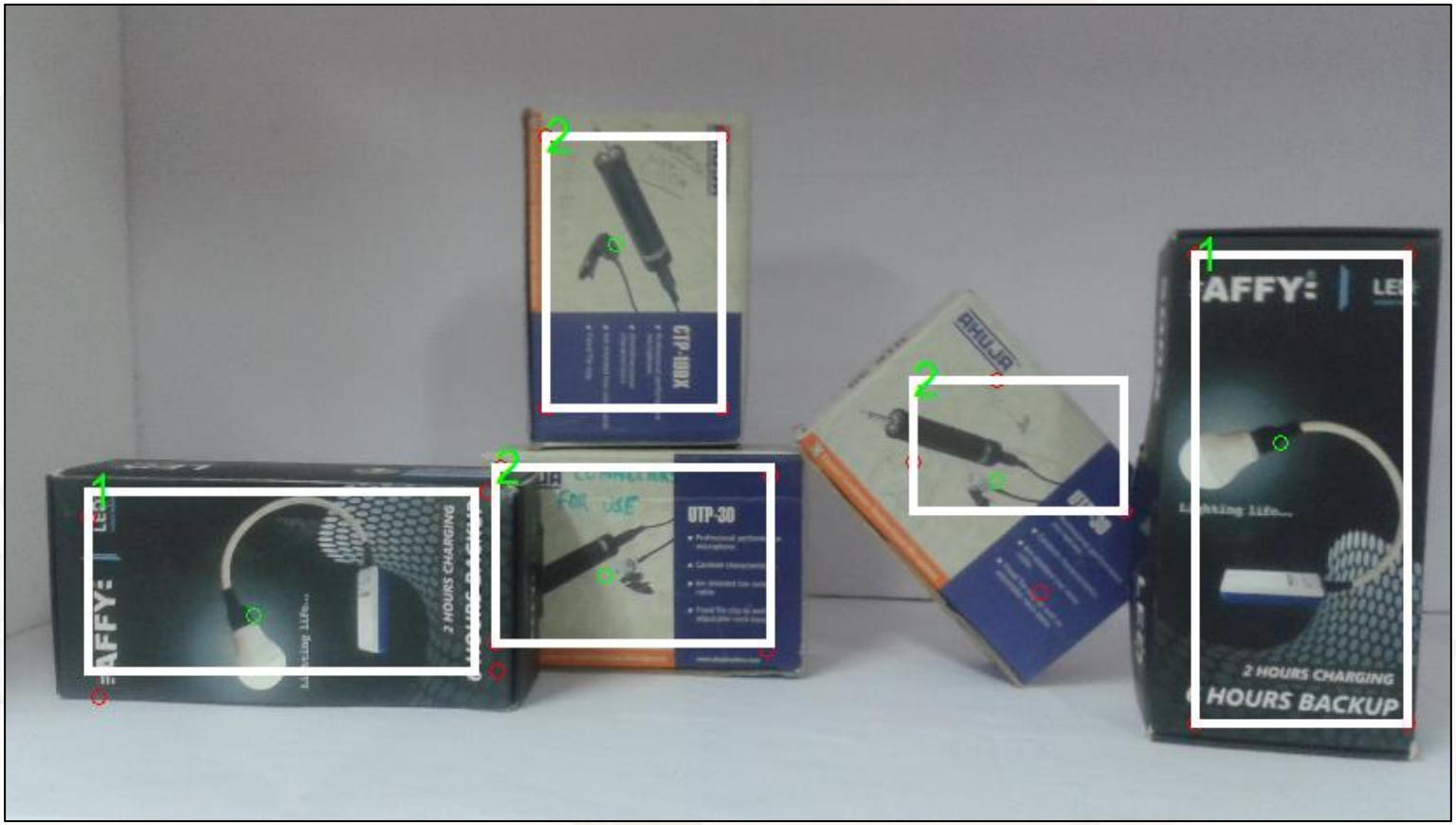
Results

Object Counting for two different prototypes

Results



Object Counting for two different prototypes

Results

Object Counting for four different prototypes

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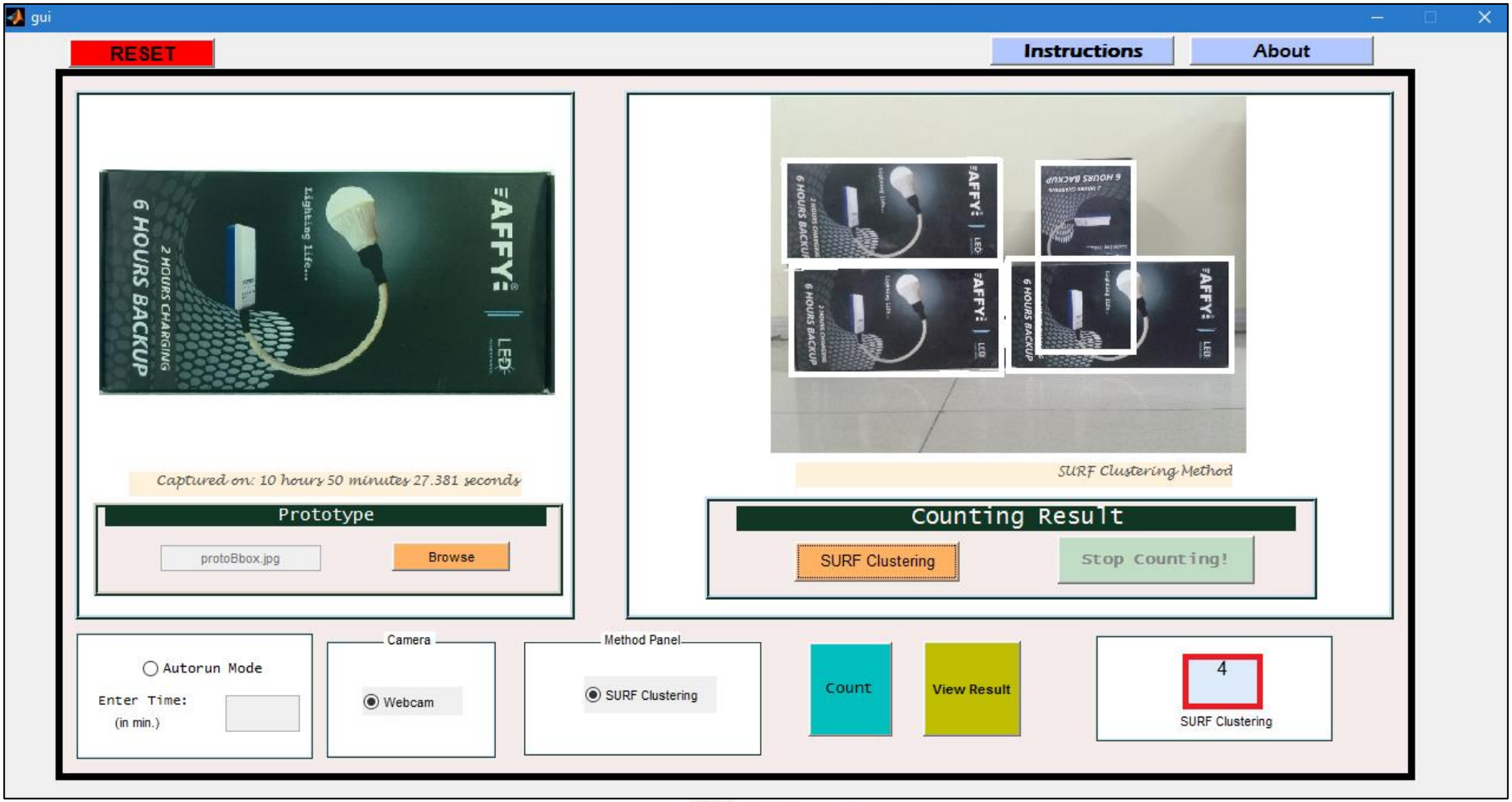
Graphical User Interface (GUI)



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Conclusion

- Proposed methodology is found reliable for inventory control in Supply Chain Network (SCN).
- It is able to give robust real time count of objects in inventory.
- Accurate count of object is achieved irrespective of:
  - Scale
  - Rotation
  - Occlusion (upto 70%)

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References

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THANK YOU