# **Image Recognition Techonology to Track Retail Store**

## Background:

Retail Scan (RS) is India’s first 100% customised, real-time sales cum retail audit company. We have been working with a host of FMCG companies across product categories ranging from food, personal care, home care, baby care, beverage etc. over the last 6 years.

RS wants to develop image recognition technology to interpret images of product, product facing, Shelf, displays, promos, assets like visi coolers, gondolas, Racks etc from retail stores. This technology will automatically match store images with images repository or database to convert images into data.

After conversion of images into data report should be viewed in Handheld and web thru RS reports.

## Process flow

## Image repository/Database

Image repository is database of all template images which is grouped by SKU, brand, sub category, category and manufacturer.

Image recognition engine use this images as base image for detection of product/object in live store images.

## Recognition engine

Recognition engine (RE) should be robust enough to identify all objects/product from image and match it with image repository. RE will identify object images based on text, shape, pattern, texture, colour, shades, logo etc.

RE should be able to match location of product on shelf based on template and create variance report.

**Image recognition engine should be robust enough to overcome following challenges:**

1. **Angle of image capture**- sometime it is difficult to click image from retail store with perfect angle primarily due to unavailability of space, hence system should overcome this and identify all object in image.
2. **Duplicate Images**: IRE should identify duplicate images in system and eliminate them from reporting.
3. **Blur Images:** Before identifying objects in image IRE should normalise all images to avoid any kind of misreporting of data.
4. **Resolution and size**: Field executive will click images from low end smart phone with camera ranging from 2 to 5 megapixels and need to upload it thru mobile data connectivity due to this image quality uploaded to server will be in low resolution and size.
5. **Lighting**: It is very difficult to get perfect lighting condition in traditional trade retail store, hence RE should enhance/normalize image or control illumination effect.
6. **Image Referencing:** The solution should be able to address the challenge of storing tens of thousands of reference images and quickly return accurate results from a reference image database.
7. **Shapes:** Different objects have different shapes. E.g. A biscuit packet can be rectangular or cylindrical. A beverage bottle will be rounded in shape. The engine should be able to pick up pre-defined attributes of various shapes of objects, match them with reference shapes of images and return accurate results.
8. **Minimise False positives and False negatives:** Often, the IRE tends to return images as false positives/negatives. Under such conditions, the interpretation will be inaccurate.
9. **Occlusion:** Occlusion obstructs vision. Hence removing occlusion is important for better object recognition. The same needs to be kept in mind while developing the computer vision algorithms. Image structure and texture may need to be re-constructed for this purpose.
10. **Stitching multiple image frames to re-create a complete bay/rack of a store:** To capture a complete rack, the surveyor needs to capture multiple images. Ideally, these individual image frames need to be stitched together as one large frame at the backend and images should be interpreted in a seamless manner to avoid duplication.

## Admin tool

**Retail Scan Admin Tool** will be web based application, which helps the Retail Scan’s user to manage the complete survey functionality’s life cycle including defining new clients, contracts, creating new survey templates, mainlining all masters data, analysing the MIS reports. In this application most of the events and alerts will in real time but will have the feature to re-trigger manually as and when needed. This application will give the access of one or multiple customer data based on role and privileged assigned to the user.

## PDA Application

**PDA Survey Tool** will be PDA allocation and will be able to capture and transfer the data/image in real time to the main server. Various different survey layouts will be created (using Retail Scan Admin allocation) for the specific customers and contracts.

Following feature should be available in PDA application

* Application should be password protected.
* PDA User have restricted rights to limit hi data access.
* Application should have feature to take unlimited images/data point.
* Identify blur and poor quality images and ask user to retake image if it is not acceptable by IRE.
* Survey can be conducted even if internet connectivity is not available.

## Client reporting

Client online reporting tool Objective:

1. Dashboard and reports should be customised for different clients and different users (within same client group).
   1. Super admin should have right to create report formats for different client login by drag and drop of various field and write query (in customised query builder format).
   2. Reports should be drill up and drill down from top to bottom level of hierarchy.
   3. Crosstab view of data or chart in reports or dashboard.
2. Graphical reports on Planogram compliance and heat should be generated.
3. Report logic can be edited/ redesign by Retail Scan (thru super admin user right)
4. Historic and past data should be viewed by client ( by weeks, cycle, monthly, quarterly or yearly)
5. Data should be viewed in both graphical (includes option to change chart type) and tabular form of data (current and past)
6. All Web reports (including tabular and graphical form data) should be downloadable in excel format.
7. Email report/scheduling should be available.

## Points to Keep in Mind while designing the system

Retail Scan will be having contracts with her clients.

* Each contract will have a start period and may have a defined end period.
* Each contract will be for a set of products/items/questions only.
* Contract product will be grouped based on Main Category, Category, Sub-category, Brand and Supplier.
* With each product client may define up to 3 competition item names.
* Each contract will be applicable for specified outlets lists only.
* Each outlet will have a unique code not only for contract for entire application.
* Each contract will define a hierarchy of reporting in the company e.g. CEO -> Country Head -> Regional Head -> Area Sales Manager -> Territory Sales Executive -> Team Leader and so on.
* Each contract will have services like sms alerts or email alerts to selected people of the client for selected products going below minimum level.
* Each contract will define different category of outlets.
* Survey Image group/questions will be designed for each outlet type.
* Questionnaire will contain only two types of questions (Answer to those will be either yes/No or count).

Survey and its procedure:

* The survey will be conducted by using a PDA device which will be given to each surveyor.
* Surveyor will update the application on PDA device each time a new contract is signed or each time a contract is changed. Surveyors will be sent SMS for updating their device once a contract is added/modified/expired.
* A surveyor will go to the outlet and first enter the Outlet ID. As already mentioned, the outlet ID will be unique throughout the application.
* Based on the outlet id, different category of Images/ placement/ questions will appear on the screen.
* On selecting a particular category, sub category will be displayed to the surveyor.
* On selecting a particular subcategory, placement/questions will be displayed to the surveyor.
* Surveyor will start capturing photograph by category/sub category
* After finishing with one subcategory, (s)he will move on with other subcategory.
* In this fashion, surveyor will finish the entire survey.
* After finishing with survey, surveyor may upload the data at that very moment, or (s)he may upload the survey later.
* PDA application should store start date time/end date time of survey.
* Surveyor will move to the next outlet.
* Surveyor may single/batch upload the survey on the web.
* In case the GPRS connectivity is not available, the PDA application should have the option of