Reducing Material Searching time by implementing 5S in Stores Department of Manufacturing Industry

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Abstract: In Today's world the industrial as well as the global markets are challenging, continuously changing and also requires the high quality products at comparatively lower cost, so in order to sustain in competitive market industries will have to provide the quality products at lowest cost. For that a management philosophy, probably called as Lean Manufacturing can be very useful to produce the products economically. Lean manufacturing is basically a manufacturing with minimal waste or scrap in terms of time, activity, motion and resources and is aimed to reduce all types of wastes at all level of manufacturing, so that the quality products can be introduced to market at minimum cost in minimum time. This paper explains the implementation of 5s methodology in stores department of an electrical component manufacturing industry to improve the efficiency of all processes of the company. This study is based on implementation of 5S system and elimination of different types of losses from the company. It can be seen that implementing the 5S system will leads to the major beneficial changes in the Industry as well as also improves its working environment, for example improving the routine working, improving the visual identifications, reduction in the scrap, less searching time, less nos. of accidents, safety, security etc.

Keywords: *5S implementation, Elimination of waste, Kaizen, Searching time reduction, Performance Improvement*

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1. Introduction:

Lean thinking represents a set of principles and techniques for the identification and elimination of waste in manufacturing and administrative processes.5S is one of them. 5S is a technique originated from Japan and it was first developed by Hiroyuki Hirano in 1980s. It include five Japanese words Seiri (Sort), Seiton (Set in order), Seiso (Shine), Seiketsu (Standardize) and Shitsuke (Sustain). The 5S philosophy focuses on simplification of the work environment, effective workplace organization, and reduction of waste while improving safety and quality [1]. 5S is a base of Lean Manufacturing systems. It is a tool for sorting of wanted items from the unwanted items, organizing the required items, regular cleaning of the work place , and providing the necessary groundwork for workplace improvement. 5S is a method to get well organized, orderly managed, well cleaned with inspection, well standardized and continuously improving a working area. 5S is not just about housekeeping, it is one of the efficiently working tools of Lean Manufacturing. The program gets its name from five activities beginning with the letter S, which were derived from five Japanese words. That are Seiri, Seiton, Seiso, Seiketsu and Shitsuke, which when translated in English mean Sort, Set in Order, Shining, Standardize and Sustain, respectively [2].

5S is a systematic methodology used by Industries, organizations and service sectors which is based on five Japanese words; Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), and Shitsuke (sustain). This system helps to organize a workplace for efficiency and decrease wasting and optimize quality and productivity via monitoring an organized environment. It also provides useful visual Proofs to obtain more effective and resistive results. Also 5S techniques would strongly support the objectives of organization to achieve continuous improvement and higherperformance [3].

This report discusses methodology to implement 5S methodology and its benefits to various production industries as well as in service sectors. This report also represents a literature review to summarize various applications of 5S. The project concludes with highlighting 5S's contribution to delight customers.5S can be performed by the small teams called as 5S teams and it is the total participation program. Involvement of Managerial heads to the ground level workers is required for its sustenance and for effective results.

The implementation of 5S leads to the improvement of the organization in many ways. It will helps the organizations in many ways for instance:

- Better utilization of working area
- Improvement in Work environment
- Prevention of tools losing
- Reduction in accidents.
- Reduction in pollution.
- Discipline amongst the employee.
- Improved moral of employee.
- Increasing of awareness of employee.
- Improved internal communication.
- Improved internal human relation.
- Decreasing of mistakes through error proofing [4].

2. 5S Methodology-The Beginning of Lean:

Fig.1. 5S Methodology

1S: Sort (Seiri)

Sorting aims for removing all the unwanted materials from the workplace. After sorting the unwanted materials from the workplace, they are placed in the red tag area and the details of it are noted down on the red tag card. The materials noted down on the red tag card are then moved to scrap yard or located properly or rectified or segregated or returned to the supplier based on the decision of apex team and zone leader [5]. The necessary and unnecessary materials available in the workplace should be sorted and classified [6]. Implementation of 5S along with the visual management will leads to the significance improvement in the work place including the proper storage of required items and the efficiently used storage space and the working area. [7]

2S: Set in Order (Seiton)

Set in order aims at "place for everything and everything in its place" [4]. After sorting, the specific location is defined for the useful material and located in the predefined order. Tools, equipment, and materials must be systematically arranged for the easiest and the most efficient access. There must be a place for everything, and everything must be in its place [8, 9]. Forming a regular workplace, avoiding waste of time while searching for material and so improving the efficiency are the main objectives [6, 4]. Improved and properly arranged storage facility leads to the saving of searching time, man/ machine motion .it will also contribute in cost saving of the company with the higher work safety. [7] Different colors can be used to indicate the different locations & different areas. Also all the required items must be properly identified and properly arranged on the fixed location according to its volume and quantity to be stored. [2]

3S: Shine (Seiso)

Shine aims for keeping cleanliness at workplaces, workstations, offices, stores, outlet, passageways, gangways, etc. in the organization. Cleaning should become a daily activity. Workplace should be cleaned at regular intervals [9]. For the effective tasks and activities, it is essential to create a clean and regular working and living environment because of dust, dirt and wastes are the source of untidiness, indiscipline, inefficiency, faulty production and work accidents [6, 4].Improved regularly cleaned and well-arranged workplace results into improved efficiency of the machines, less scope of human errors, clean and easy to check work place and the healthy accident free work place. [7] Shop floors washed away and must be cleaned with inspection at regular basis schedule. Also storage shelves and storage bins are required to be cleaned. [2]

4S: Standardize (Seiketsu)

To strictly follow the first '3S' in the daily routine, the 4th 'S'- Standardize is used. Standardize aims for the preparation of standard methods to continue to follow the first '3S' effectively in the organization [10]. To establish standards of the best practice in the place of working and to ensure that the standards are compiled and to undertaking that the workplace is clean and tidy at all times [11]. It is required to choose the best way to practice sort, set in order and shine after there is a need after some period to choose the best ways to practice sort, set in order and cleaning and abide by them [12].All the activities within the department must be standardize to eliminate the waste and to improve the work place. [7] Formulation of rules & working standards and its strict establishment is necessary for the improvement in the departmental and organizational operations and work flow [2]

5S: Sustain (Shitsuke)

Sustain aims for maintaining the implemented '5S' system effectively. Thus, in short, sustain defines the discipline for employees to strictly follow the implemented '5S' in the organization to obtained the required result [10]. Employees are trained for practicing 5S system

continuously so that it becomes the habits and culture within the organization [13, 14]. The task here is undertaken by the leader directors. The directors should explain the importance of 5S to the personnel through various training and the knowledge of the personnel about 5S should be kept updated through the 5S boards to be formed at the workplace [6]. It is also required to understand the need of executing the routine inspections and follow-up on 5S steps. This inspection and follow up is executed by the Check List and created on its basis the radar graph of the 5S, which serves to an estimation of the workplace. The inspection of realization of the 5S Practice is executed and verified once in a month by chosen team implementing the 5S – the 5S team [15].

3. Literature Review:

Vipul Patel [7] et al explained the work carried out to implement 5S methodology of lean manufacturing to solve the problem of a ceramic industry with the aim to increase the efficiency of all processes and elimination of losses in the company. The objective of this research is to reduce the waste within the process, smoothen the process flow and maintain proper quality control, Improve storage facility, safety, security, process cost saving in the company through this case study. This study shows that due to implementation of 5S and visual management system (GAMBA), there was improvement in space utilization, safety of the employees, less scope of error, increased productivity, and improved inventory system, also increasing of machines efficiency, maintenance the cleanness of devices, maintenance and improvement of the machines efficiency, maintenance the clean workplace, easy to check, quick informing about damages (potential sources of damages),improvement of the work environment, elimination of the accident's reasons in the company.

S.B. Khedkar [10] et al in this study shows the implementation of 5S methodology in the Plastic Industry. It will impact the instructors and workman of Industry that work within the selected working place. By following the 5S methodology, this research work may show significant improvements to safety, productivity, efficiency, and housekeeping. Also the production rate was improved will increase due to systematic arrangement, The space utilization will increase, The atmospheric conditions will improve, Clean and hygienic condition is achieved, It is convenient to handle and operate each and every material, Moral support of the operators and workmen's are improved, also the Storage space is increased within the same area.

R.T. Salunke [2] et al explained the different management techniques like 5S, kanban system and Kaizen system in his research. Main aim of this study is to reduce the material searching time of spares and reduce the level of inventory. This study shows that 5s system is helpful to understand the actual condition of spares in store department and it also helps in managing the spare parts in store department.The kanban system helps to maintain and control the inventory level to the optimum level. The different kaizens helps to make the store department easy to access to the spares parts. The results of this study shows the improvement in reduction of material searching time and also controls the cost of the inventory by maintaining inventory to the optimum level through 5S, Kanban and Kaizen systems. Also the results of this study shows that material searching time is reduced from 10-15 min to 6-8 min.

4. Case study:

This case study is carried out at one of the leading electrical based product manufacturing company. The area for this case study is the stores department of the manufacturing unit,which houses the large numbers of materials and raw materials, also that mateials are not stored properly. Based on one analysis conducted at stores department we found some lags and bottlenecks.Morever, there is large numbers of materials so that materials have to be found out while in requirements at production lines. This situation results into large material searching time and sometimes temparary loss of materials. In present system materials traceability is too poor and also no enough storage space is available in the stores department, so both this factors will results in to larger material searching time and accumulation of materials on gang ways and shop floors further which results in to poor working condition of stores departments. To overcome this problem it is necessary to identify the key areas, which are producing wastes, and determining the bottleneck operations in supply chain. The aim of this study is to minimizing the waste,materials seraching time by using 5S-lean tools,to serve the best practices to the customers.

1S- SORT: Segregation of materials/CAT Numbers:

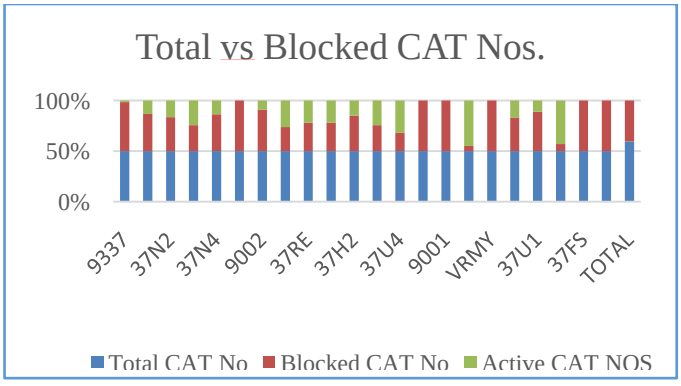

Fig.2. Total vs. Blocked cat numbers

Here in first phase of 5S we planned to refine the working area physically as well as also decided to refine the number

of material in system (SAP). We found that system is having large numbers of cat numbers including active cat numbers, non-active cat numbers and dummy cat numbers. So very first we need to segregate the total cat nos. which comes under the stores location. As a result of the activity we found that only 2544 cat nos. are active and comes under stores location. After the verification of the system (SAP) according to the movement and transaction of the stock of the materials, we found that 71% of the cat numbers are non-active or either dummy or obsoleted cat numbers, only 29 % of total cat numbers are active cat numbers.

Also the stores and its storage locations are physically verified for unwanted, expired and rejection materials. Here after verification of materials in SAP as well as physically on storage area, we observed that many unwanted materials are there within the work place.so that materials are segregated from the required materials and same will be given a red tag for the disposal purpose.

Fig.3. Red Tagging & Red Tag area

Here the condition of scrap area before and after the sort phase is shown as under:

Before **After**

Fig.4. Before after conditions of Sort Phase

2S-SET IN ORDER:

After sorting the necessary 29% of materials from the total materials. The next task is to set them in order, as per their requirement, as per their Stock dispatch quantity. Also labelling necessary items so that they are easy to find and put back. This means a place for everything (necessary) and everything in its place. No more homeless items.as the result of this activity the required item can be made available in least time from its fixed location in the system as well as fixed location on storage area. This activity is also called as PEEP "PLACE FOR EVERYTHING, EVERYTHING ON ITS PLACE"

PEEP Methodology:

- Analysis of current situation
- Getting list of materials from Production Lines
- SDQ From Buyers (Concerned Person From Company)
- Physical verification of material (with store to production line)
- Temporary location with coloured chalk or removable stickers
- Labelling of Every Required items with Proper location
- Updating locations into SAP

Here the month wise percentage of PEEP is shown.

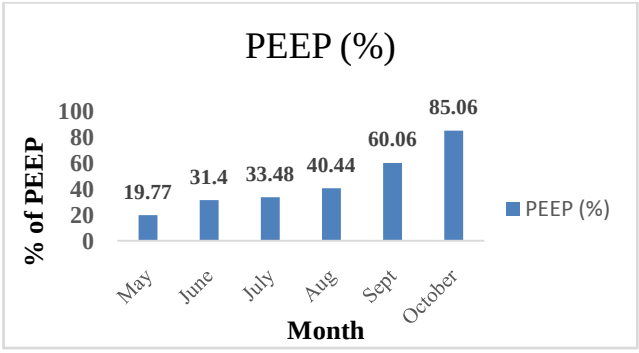

Fig.5. Month wise %of PEEP

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After giving location to 85% number of necessary materials out of 100% there is no excess space available for remaining materials so we need to modify the layout of the store department. Total available storage area before the re-lay outing is around 978 Sq. m, from the re-lay outing we get around 429 Sq. m excess storage space.so we have total around 1407Sq. m Storage area. So after the modification of layout we have sufficient space in stores department for giving locations to the remaining 15% of the necessary materials.

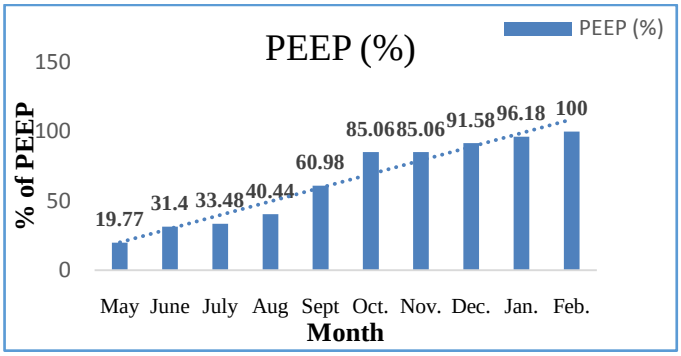


Fig.6. Month wise %of PEEP

Here during our study in the month of February we reached up to 100% PEEP. All the necessary materials were given their permanent place/location. And also their physical locations were updated into the system used for the transactions of the materials/stock of material. After the 100% PEEP we again measured the materials searching time for the different locations within the stores. The material searching time before and after the set in order phase is measured and compared.

Materials searching time for single cat nos. of each storage location is selected manually and time for searching is measured for the same Here the 8 components form 8 different storage locations are selected manually and material searching time after the 100% PEEP is measured and compared with the material searching time before the PEEP.

COMPONENT	A	B	C	D	E	F	G	H
TIME IN SECONDS **BEFORE PEEP**	152	122	171	162	158	119	152	116
TIME IN SECONDS **AFTER PEEP**	42	44	57	41	54	54	57	54

Table.1. Before vs. After material searching time

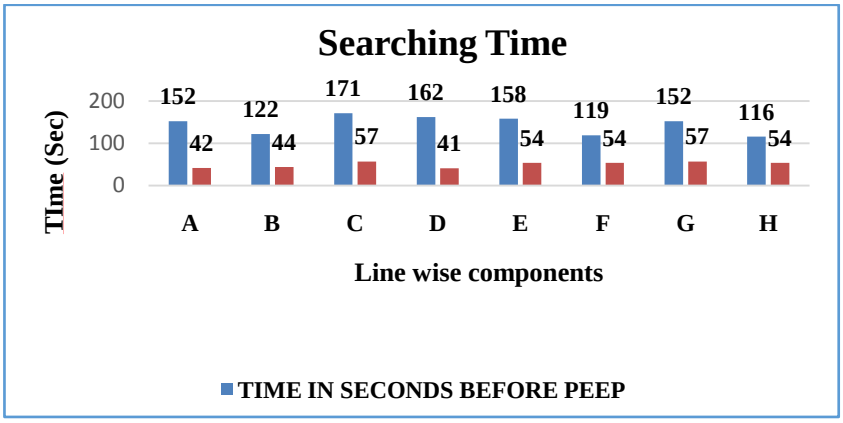
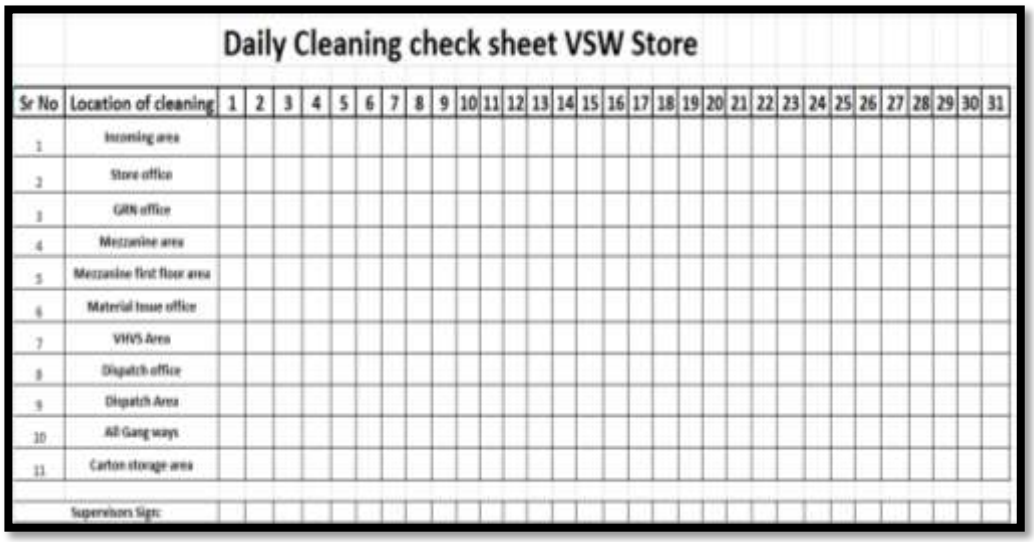


Fig.7. Before vs. After material searching time

3S: SHINE:

It means cleaning with inspection. Here the daily check sheet is prepared for the effective cleaning and daily follow up and inspection. All the areas of the stores departments are required to be cleaned regularly to maintain the cleanliness and neatness in the working area. In order to avail the effective cleaning the daily cleaning sheet is prepared and implemented as the routine in the system. The storage racks, bins, tote boxes and all the effective areas of the stores are cleaned properly on daily basis.



Daily Cleaning check sheet VSW Store

Sr No	Location of cleaning	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Incoming area																															
2	Store office																															
3	GRN office																															
4	Mezzanine area																															
5	Mezzanine first floor area																															
6	Material Issue office																															
7	VHVS Area																															
8	Dispatch office																															
9	Dispatch Area																															
10	All Gang ways																															
11	Carton storage area																															
	Supervisors Sign:																															

Fig.8. Daily Cleaning sheet

4S: STANDARDISATION:

Store Department consist of three sections in itself. Material incoming area, Material Issue area and materials dispatch area. So in order to avail the standardization in all these area. The working procedures were observed and the bottleneck/inefficiencies are analysed. So in order to effective and efficient working, standard procedure of working is prepared and also the training regarding the Standard procedure is given to the workers.To establish standards of the best practice in the place of working and to ensure that the standards are compiled and to undertaking that the workplace is clean and tidy at all times. Best way to perform the above three 'S' are found out and also in order to fulfil this requirements Standard SOP for the same is prepared.

Also color code is used for maintaining the FIFO in Stores department. Labels of different colors according to successive month is designed and also applied to the material at their time of arrival in the incoming stores area for their first in first out (FIFO).

FIFO MONTH COLOR CODE MATRIX		
Sr No	Month	Color Code
1	January	
2	February	
3	March	
4	April	
5	May	
6	June	
7	July	
8	August	
9	September	
10	October	
11	November	
12	December	

Fig.9. Color code for FIFO

Standard SOP prepared for

1. Material Incoming
2. Material Issue
3. Material Dispatch

Also with SOP

- Various one point lessons are prepared for the activities
- The daily checklists were carried out.
- The safety standards are ensured and followed and Use of PPE is ensured by the introducing the workers regards the importance of their safety.
- The specific procedure are planned and was followed.
- All obligatory rules in the company are obeyed.
- Establishment of Rules and Standard Operation Procedure (SOP)
- Improvement in operation and workflow.

5S: SUSTAIN:

Here the aim of this last S is to sustain whatever the cleanliness and orderliness is achieved.Here its success is depends upon the follow up of standards as routine or daily activity. For the effective sustenance it is necessary to Increase the awareness amongst workers and the supervisors about how 5S can be useful to their work and their department, because 5S is a group activity and a total participation program. The effective results can only be achieved by participation of all from top level managers to workers.

1. Training to the workers:

Training is given to the workers for material incoming, material issue and material dispatch areas. Also all the SOP'S were prepared in local languages so that workers can easily understand the procedures. Safety training is also given to the workers and also the various poster presentation and safety slogan competitions are organized in the stores department. Also one group activity called as Gemba (Daily 5 min. discussion) is started in the stores department.On job training as well as office room training is given to the best operators to add the quality in their work.

2. Kaizen Implementation:

Kaizen cum suggestion policy is introduced in stores department. Here in this program the operators are motivated to register/perform the possible kaizen that can be possible in any section of stores. And the efforts area made to perform the kaizen given by the operator.At the end of the month Best Kaizen Award is given to the operator who have registered the best Kaizen idea/concept.Operator is rewarded by some gifts, chocolates or some cash prizes.

Fig: 10 Kaizen Implementation and reward recognition

3. Daily work management:

DWM Policy is introduced in stores department which aims for tracking of same major key activities within the stores on daily basis, so that any lag in the particular activities can easily be identified and the root cause for the same is brainstormed, and accordingly corrective actions are taken to improve the activities

4. Check sheets:

For the sustenance of whatever achieved during the each stage of 5s activity, a continuous observation of the working area is mandatory. So in order to carry out the continuous observation and evaluation daily, weekly and monthlycheck sheetsare formed and introduced as routine activities.

5'S Checklist

Sr. No.	Check Point	Date 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Daily Check Points																															
1	Unnecessary items on Gangway																															
2	Material not available for QC inspection																															
3	Visual tracking boards																															
4	Floor Cleaning																															
5	Floors & Gangways																															
	Weekly Check Points																															
6	Red Tag Area																															
7	Check for any loose wiring/Electrical fa																															
8	Material Handling Equipment																															
	Monthly Check Points																															
9	H & S																															
10	Document storage																															
11	Scrap Area																															
	Operator Signature																															
	Supervisor Signature																															

Fig: 11 5S Check sheet

5. 5S Audit:

In order to check the effectiveness of implemented 5s, we have gone through the 5S Audit in current, and we have secured the Top Position in Whole plant. Our plant (5 departments) has scored average of 61 point out of 100. Amongst them stores department scored the highest 74 points.

5. Outcomes

Materials Traceability Improvement:

- Difference between materials searching time before and after peep is shown here.
- Here the before and after searching time is the averagesearching time for the materials of different storage locations.

- Materials searching time for a single no. of cat number.

Before PEEP	After PEEP
214 sec.	50 sec.

Table: 2

Material Storage area Improvement:

Storage area before Layout Modification (On rack storage)	Storage area after Layout Modification (On rack storage)
978 Sq. meter	1407 Sq. meter

Table: 3

- Here storage capacity of stores department is increases up to around 43% of previous available storage area through layout modification.

Another Outcomes:

- Improved Working condition and working area
- Improved morale of workers
- Reduced numbers of accidents
- Reduced numbers of mistakes
- Easy reach to all areas of the store department
- Improved visualization and identifications
- Reduced level of material discrepancy
- Improved awareness of 5S amongst Workers

6. Conclusion:

By performing the technical suitability, economical justifications and feasibility analysis, we have suggested the recommendations of these tool to induct for the medium scale enterprises confidently. In this study by Implimenting the 5S and PEEP the material serching time can is reduced to 50 seconds from 214 seconds,also the storage area is improved to 1407 Sq. m from 978 Sq. m. The working procedures and working area is improved and by clear identifiaction and effective visulaization any area within the stores can easily reachable and accesible in lesser time as compared to before.

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