iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** II **Month of publication:** February 2024

DOI: https://doi.org/10.22214/ijraset.2024.58649

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue II Feb 2024- Available at www.ijraset.com

A Work Study for Upgradation of Plastic Product Manufacturing Unit

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Abstract: ***This paper discusses about the project on work study of plastic product manufacturing unit.The factory is well renowned for its plastic products .This unit is present at Electronic Zone, Hingna MIDC ,Nagpur .This factory has plastic injection molding machine for product manufacturing .In the project ,we will study examine ,investigate about the existing ways of doing work. We are going to do systematic recording and critical examination of existing working structure ,plant layout ,management ,allocation of work to workers ,way of completion of work from taking delivery of raw materials upto delivering finished products. We are using principles of Industrial Engineering which comprises work study,method study ,work measurement ,plant layout, material handling ,ergonomics to study the existing ways of production in the industry. Our purpose of studying the existing way is to find out loopholes in the current process and to eliminate all unnecessary operations and waste .Again, We are identifying non-value adding operations while investigating all operations processes .This study will guide us to discover new ways of doing work with developing and applying more effective methods to reduce cost, increase overall productivity and efficiency.***

Keywords: Plastic Injection Molding Machines ,Work Study, Method Study, Plant Layout, Industrial Engineering and its Applications, Automation, Robots, Material Handling, Ergonomics, Productivity, Efficiency.

I. INTRODUCTION

A. Plastic Injection Molding Machine

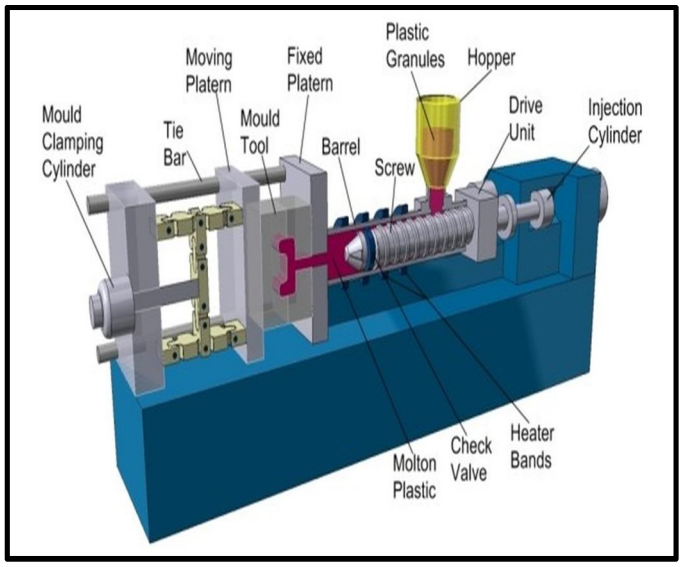


Fig 1:A figure if plastic injection molding machine

Working Principle: The principle of injection molding is that the plastic material is heated until it turns into a viscous melt.This is then forced into a closed mold that has the the shape of the article to be produced. There the material is cooled until it occupies solid state, then the mold is opened and the finished part is taken out.

Raw Material includes Polypropylene, Plastic granules also known as Raw Plastic Pellets.

Applications: Plastic injection molding help manufacture products varying from simple food packaging to medical devices such as syringes and inhalers.Plastic boots, sinks and bath tubs,Plastic cutlery,marine objects like small boat hulls ,toys and flower pots,keyboard covers, are a few of the multitude of things produced from just this process.

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Fig 2:Products made from plastic injection molding machine.

About Company**:**


Fig 3:A image of plastic product manufacturing company


Fig 4:A image of plastic injection molding machine

The company in which studies are done manufactures variety of plastic products .The company has more than a dozen of Plastic Injection Molding machines. By using the Injection molding machines company produces multiple plastic products such as Container caps, Bowl, Plate, Tub, Tiffin Box, Basket, Tray, Brackets, Mugs, Soap Case, Candy box, Toys, etc. Approximately 400 different types of plastic products are manufactured .The weight of this manufactured products ranges from 50 grams to 350 grams. The above products are manufactured by the team work of 40 workers.

II. RELATED TERMINOLOGIES

1) *Work Study:* According to Martand Telsang(1)"Work study is referred as term for the techniques,work measurement & method study which are used in examining of human work and which lead step by step investigation of all the factors which affect the efficiency and productivity of the process being reviewed in order to improve it. "
2) *Method Study:* " Method study is proper step by step recording and detailed examination of existing and proposed ways of doing work,so as to apply easier and more effective methods to do work and reduce costs."
3) *Work Measurement:* "Work measurement may be defined as the application of tools and techniques designed to establish the time for a qualified skilled worker to carry out a specified job with good performance level".
4) *Work Sampling:* Work Sampling can be defined as, "A technique in which a number of observations are taken, over a certain period of time, of a machine,group of machines, processes or workers .Each observations recorded for a particular activity or delay tells about percentage of time observe by the occurrence".
5) *Plant Layout:* According to Moore,"Plant layout is a plan of an optimized arrangement of facilities including operating equipment, personnel,material handling equipment, storage space and all other supporting services along with the design of best layout which contain all these facilities".
6) *Material Handling:* Haynes defines "Material handling relates with the movement of bulk,packaged and individual products in a semi-solid form or solid state by manually or by power-actuated equipment and within the industrial limits of individual producing, fabricating, processing or service unit."
7) *Productivity:* Productivity relates to the efficiency of production system. It is an indicator which tells about how well the factors of productions are utilized i.e. utilization land, labor ,capital and energy.
8) Productivity =Output /Input
9) *Operation Process Chart:* An operation process chart also known as outline process chart which records only the major activities and inspections involved in the particular process.
10) *Flow Process Chart:* The flow process chart is the detailed version of the operation process chart in which operations, inspections, storages ,delays and transportations are represented.

III. OBJECTIVES OF THE WORK STUDY

1) *Studying existing process:* In the project ,we will study examine ,investigate about the existing ways of doing work.
2) *Recording and Examining the Processes:* We are going to do systematic recording and critical examination of existing working structure ,plant layout ,management ,allocation of work to workers ,way of completion of work from taking delivery of raw materials upto delivering finished products.
3) *Problem Identification:* Our purpose of studying the existing way is to find out loopholes in the current process and to eliminate all unnecessary operations and waste .

IV. STUDY METHODOLOGY

1) Conducting process mapping and plotting the process chart .
2) After above mapping step is done identification of required time for processes is to be done.
3) Comparison of standard time with observed time to eliminate extra time consuming process.
4) Formulating the problems to reduce time consumption and conducting method study ,observing and identifying existing areas where improvement can be done.
5) Suggestions of new method to concerns.

V. STUDIES AT COMPANY AND OBSERVATIONS

A. *Plant Layout :(Present Plant Layout)*

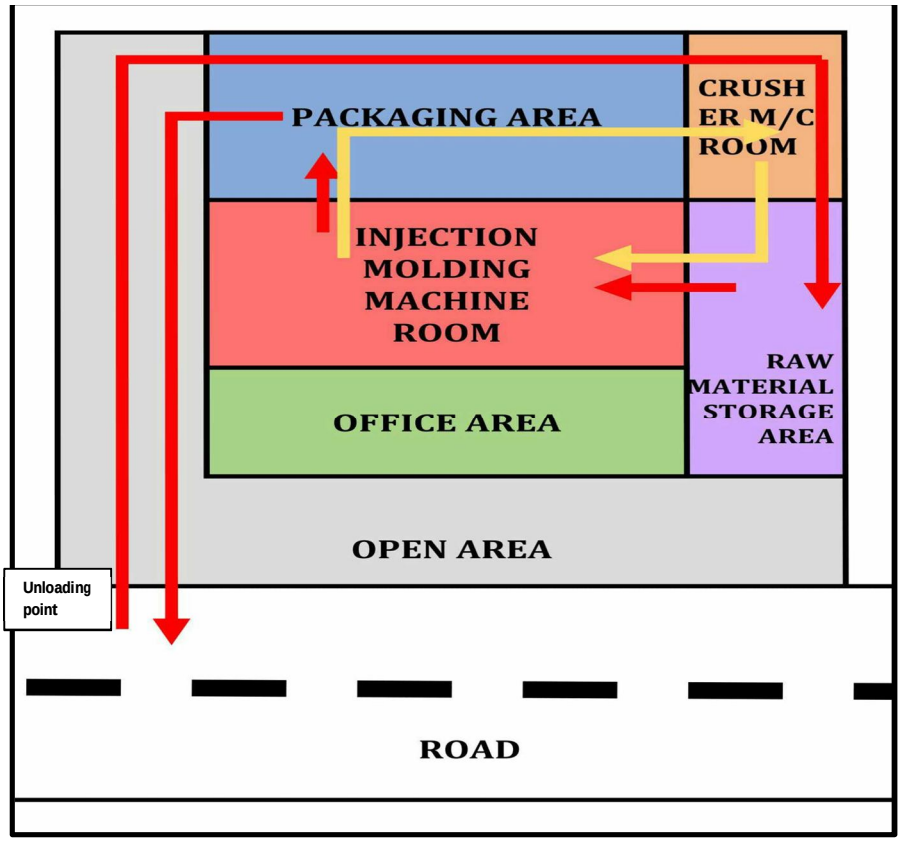


Fig 5:Present plant layout and material flow figure

- Material Flow is shown in *Two Colored Lines* Viz. *Red* and *Yellow*
- *Red Line:* From Unloading Raw Material To Finished products out for Delivery
- *Yellow Line:* From M/C room to Crusher room for Crushing of Waste Plastic Material and again to M/C room for Reuse.

Time Study Observations :

Time study observations of some important processes :				
SR. NO.	PROCESS	TIME REQUIRED	DISTANCE TRAVELLED	MANPOWER UTILIZED
01	Unloading of Raw Material	60 minutes	40 meters	4 workers
02	Mold Changing Operation	45 minutes	5 meters	2 workers
03	Packaging Operation	-	-	15 workers
04	Total Material Travel	-	65 meters	-

B. Flow Process Chart (Material Type) [Present Method]

*Task***:**Manufacturing of Plastic Plate.

*Chart Begins***:** Receiving Raw material at unloading point

Chart Ends: Finished assembly kept in rack out for delivery.

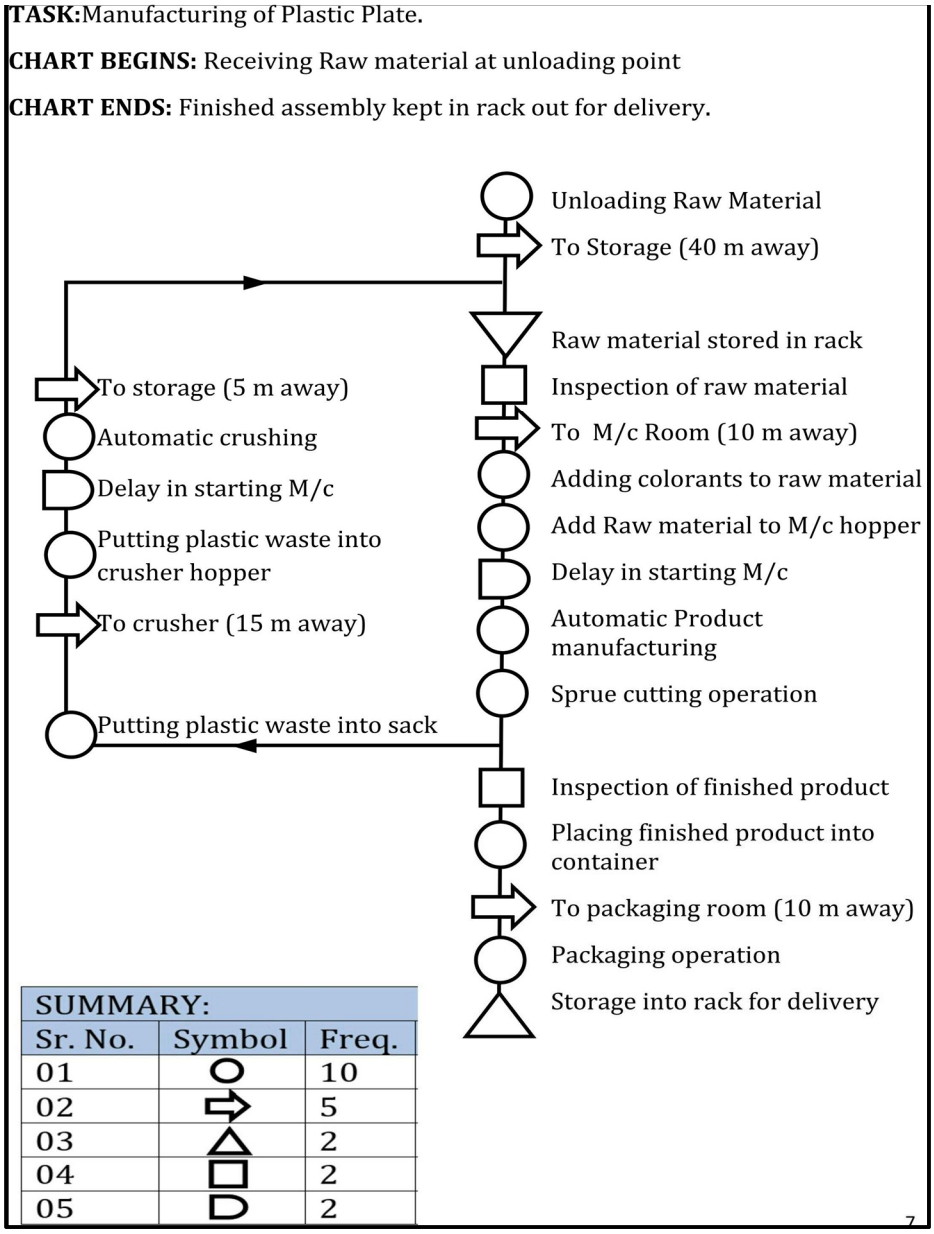


Fig 6:Flow process chart of Manufacturing of Plastic Plate

VI. MAJOR PROBLEM IDENTIFICATION

1) *Unloading and storage of Raw material* **:**A group of workers have to unload approximately 2500 kilograms of raw material manually by placing sacks of 25 kilograms of raw material on their back and travelling a distance of 40 meters away from unloading point to raw material storage room. In this process of raw material unloading, following problems were identified :

- Long travelling distance (40 meters approx.)
- More utilization of no. of workers(4 workers used)
- Manual process hence time consuming (45-60 min required)

2) *Manual Mold Changing Operation :* Approx 4 workers required for changing mold manually which weighs 100-150 kilograms approximately and 30-45 minutes required to change die of plastic injection molding machine.

- Lifting and travelling die manually creates fatigue (die weight 100-150 kilograms for 10 meters distance)
- More utilization of no. of workers (4 workers used)
- Manual process hence time consuming (45-60 min required)

3) *Un uniform Packaging Flow line:* No proper packaging steps followed hence more number of workers required (approximately 15)for packaging process.
4) *Improper Plant Layout:* By observing the processes and plant layout, it is observed that space utilization is below average. This creates disturbances to other operations and processes.

VII. LITERATURE REVIEW

1) Martand Telsang(1) written all about industrial engineering, it's objectives, tools and techniques of industrial engineering in his book following which multiple studies were done in company for studying present method of production.
2) V.P.Kulkarni(2)Focused on improving productivity by reducing worker's time consumed in the process in unwanted operations and ensuring minimum material handling to reduce the employee fatigue.
3) Ashish Kalra, & Sumit Sharma (3)presented ideas to improve productivity which can be used by automobile industry to reduce the cycle time of the bottle neck operations, by utilizing the concept of method study and time study i.e. by work study techniques.
4) Ravikumar Kamble(4)and Vinayak Kulkarni in their paper explained the study about productivity improvement at work station using work study techniques.
5) M.D.Singh[5]tells that productivity is "doing more with less". He also tells that productivity can be measured using multiple techniques and one of these techniques is work study.
6) J. Prokopenko(6)defines productivity as efficient use of resources; labor, land, money, materials, energy for the production of various goods and services. He writes that productivity is the relationship between results and time it takes to complete them. The lesser the time it takes to achieve the desired results, the more productive the system is; or vice versa.

VIII. CONCLUSION

From above studies, we can conclude following points :

1) Using industrial engineering tools and techniques, we have studied the existing / present processes.
2) We have recorded the plant layout, flow process chart (material time) and also conducted time study.
3) By studying the problems related to plant layout, more utilization of workforce, more time consumptions were identified.

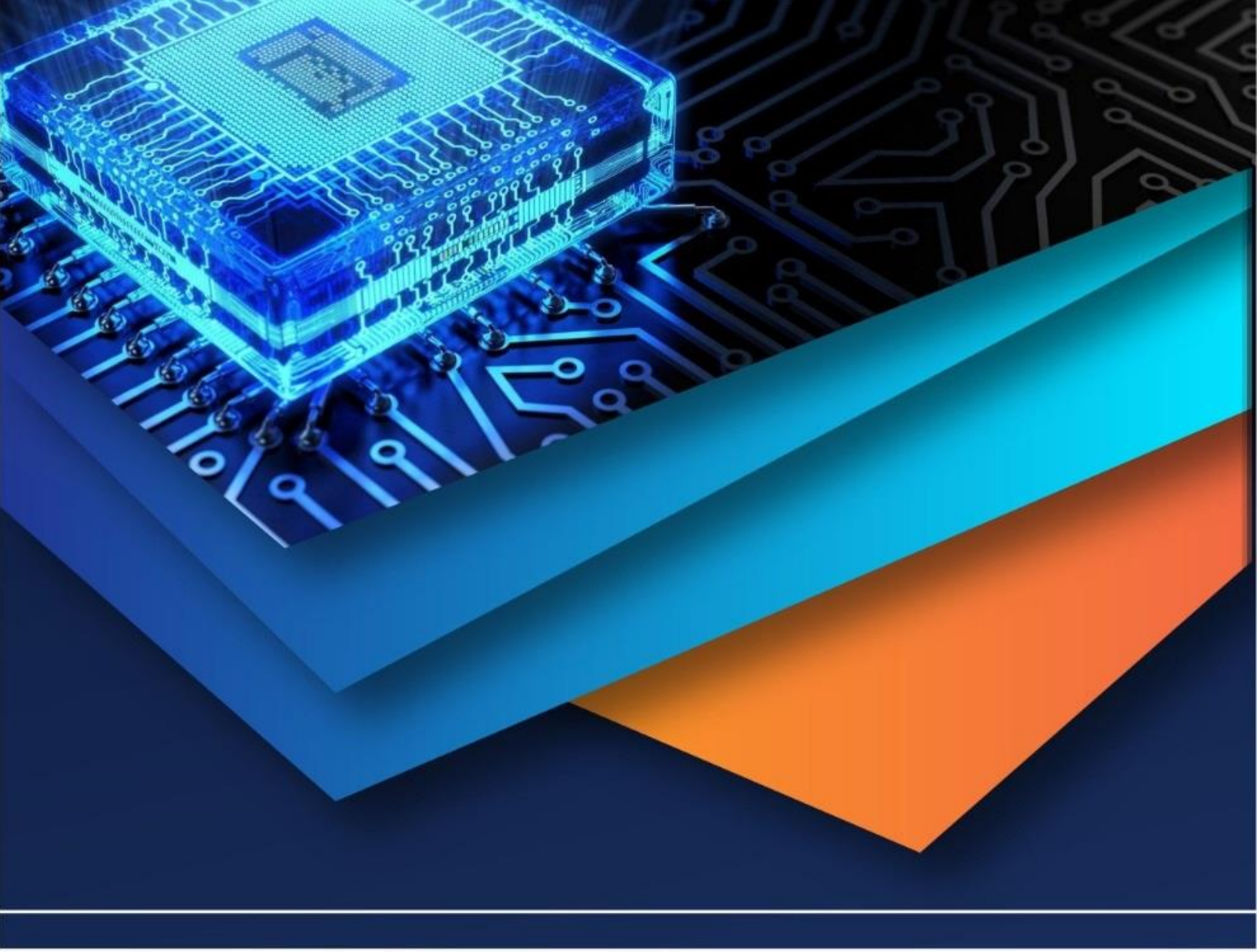
IX. MAJOR SUGGESTIONS /MODIFICATIONS TO BE DONE

1) Redeveloping plant layout and finding separate raw material unloading point to reduce travel distance to raw material storage room.
2) Use of automatic mold changing system to reduce time and manpower use required in the operation.
3) Use of comb and dendrites material flow pattern to ease packaging.
4) Use of material handling equipments for transferring of materials within industry .

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