

Material Handling Equipment for Small Scale Industry

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ABSTRACT: In a company Maruti Grinding Works, they facing problem of material handling in their premises many of equipment available for industrial application automatic guided vehicle is one of it. Automatic guided vehicle can be used with different drives like hydraulic, pneumatic or mechanical.

An automated guided vehicle or automatic guided vehicle is a mobile robot that follows markers or wires in the floor, or uses vision magnet or laser for navigation. They are most often used in industrial application to move material around a manufacturing facility or warehouse.

Human error has negative effect on safety, efficiency & quality this expense are reduced with the introduction of Automated Guided Vehicle (AGV).

KEYWORDS: Guided vehicle, Material Handling, Remote Controlled, Automatic

I. INTRODUCTION

Automated Guided Vehicle System :- Transport material from loading to unloading stations highly flexible, intelligent and versatile material handling systems. A very flexible solution for the problem of integrating a new automated transportation line into an existing transportation environment by using automatic guided vehicle.

First AGV developed in 1954 by A. M. Barrett, Jr. Using a overhead wire to guide a modified towing truck pulling a trailer in a grocery warehouse. Subsequently, commercial AGV were introduced by Barrett.1973, Volvo developed automated guided vehicles to serve assembly platforms for moving car bodies through its final assembly plants. Later, Volvo marketed their unit load AGVs to other car companies.

The first AGV was brought to market in the 1950s, by Barrett Electronics of Northbrook, Illinois, and at the time it was simply a tow truck that followed a wire in the floor instead of a rail. In 1976, Edge min Automation (Holland, MI) started working on the development of an automatic driverless control system for use in several industrial and commercial applications. Out of this technology came a new type of AGV, which follows invisible UV markers on the floor instead of being towed by a chain. The first such system was deployed at the Willis Tower (formerly Sears Tower) in Chicago, Illinois to deliver mail throughout its offices.

In an automated process, LGVs are programmed to communicate with other robots to ensure product is moved smoothly through the warehouse, whether it is being stored for future use or sent directly to shipping areas. Today, the AGV plays an important role in the design of new factories and warehouses, safely moving goods to their rightful destination.

is mechanical equipment used for the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. The different types of material handling equipment can be classified into four major categories: transport equipment, positioning equipment, unit load Formation equipment, and storage equipment.

1. **Transport equipment** :- Transport equipment is used to move material from one location to another (e.g., between workplaces, between a loading dock and a storage area, etc.), while positioning equipment is used to

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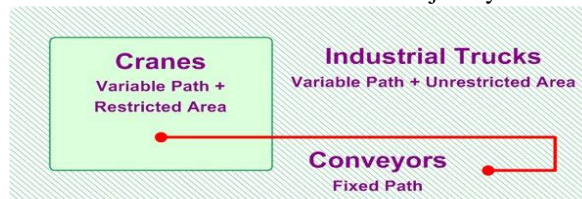
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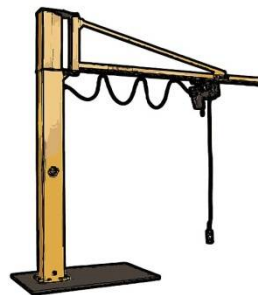
manipulate material at a single location. The major subcategories of transport equipment are conveyors, cranes, and industrial trucks.

- a. **Conveyors** :- Conveyors are used when material is to be moved frequently between specific points over a fixed path and when there is a sufficient flow volume to justify the fixed conveyor investment.



(a)

- b. **Cranes** :- Cranes are used to transport loads over variable (horizontal and vertical) paths within a restricted area and when there is insufficient (or intermittent) flow volume such that the use of a conveyor cannot be justified. Cranes provide more flexibility in movement than conveyors because the loads handled can be more varied with respect to their shape and weight.



(b)

- c. **Industrial trucks** :- Industrial trucks are trucks that are not licensed to travel on public roads (commercial trucks are licensed to travel on public roads). Industrial trucks are used to move materials over variable paths and when there is insufficient (or intermittent) flow volume such that the use of a conveyor cannot be justified.



(c)



(d)

- Positioning equipment** :- Positioning equipment is used to handle material at a single location. It can be used at a workplace to feed, orient, load/unload, or otherwise manipulate materials so that they are in the correct position for subsequent handling, machining, transport, or storage.
- Unit load formation equipment** :- Unit load formation equipment is used to restrict materials so that they maintain their integrity when handled a single load during transport and for storage. If materials are self-restraining (e.g., a single part or interlocking parts), then they can be formed into a unit load with no equipment.
- Storage equipment** :- Storage equipment is used for holding or buffering materials over a period of time. The design of each type of storage equipment, along with its use in warehouse design, represents a trade-off between minimizing handling costs, by making material easily accessible, and maximizing the utilization of space (or cube).

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II. LITERATURE STUDY

1. Research paper on **“Estimation and Control of an Automated Guided Vehicle”**
In this paper a control strategy of Automated Guided Vehicle (AGV) is proposed. The vehicle movement controlled by an inboard PLC do not need physical guide. . This paper also addresses the problems of factory navigation and modelling with focus on keeping automatic travelling along the control path of the AGV.
We conclude that the vehicle can reach from the initial position moved along with generated path with accurate location. Future work is planned to increase the accuracy of the system by equip more sensors for observation technique.
2. Research paper on **“A Review of Design and Control Of Automated Guided Vehicle Systems”**
Most key related issues including guide-path design, estimating the number of vehicles, vehicle scheduling, idle-vehicle positioning, battery management, vehicle routing, and conflict resolution. , we propose a decision framework for design and implementation of automated guided vehicle systems, and suggest some fruitful research directions.
discussed several key issues in AGV system design and implementation. These issues include guide-path design, estimating the required number of vehicles, vehicle scheduling (dispatching), idle vehicle positioning, battery management, vehicle routing, and conflict resolution. Next important issue is estimating the required number of vehicles.
3. Research paper on **“Development of an Automated guided Vehicles in Industrial Environment”**
With the advancements of robotic technologies, the industrial environments are adopting more and more aspects of automation to enhance product quality and accuracy and to reduce product cost. The use of such system is applicable for any cyclic process in an industry, enhance the productivity of any industry taking care of safety measures and will also ensure good quality of product. The automation will ensure the good quality of product.
4. Research paper on **“Wireless Control of an Automated Guided Vehicle”**
This paper represents the design, implementation, and experimental results of a Radio Frequency (RF). The present paper presents the design, implementation and experimental results of Radio frequency (RF) based wireless control.
5. Research paper on **“Design and Control of Automated Guided Vehicle Systems: A Case Study”**
In this paper, we study the design and control of automated guided vehicle (AGV) systems, with the focus on the quayside container transport in an automated container terminal.
In this paper, we give a solution to the design and control of the AGV system for an automated container terminal. To somehow weaken this restriction may be important for some applications where the workspace of the AGVs is very limited. Another interesting topic is to equip the AGV system with some fault-tolerant mechanisms so that it can still run safely and smoothly with unexpected disturbances.
6. Research paper on **“Design and Development of an Automated Guided Vehicle for Educational Purposes”**
An Automated Guided Vehicle (AGV) is a set of cooperative driverless vehicle, used on manufacturing floor and coordinated by a centralized or distributed computer-based control system.
An Automated guided vehicle (AGV) is defined as a set of cooperative driverless vehicle, which is used on manufacturing floor and coordinated by a centralized or distributed computer-based control system.
7. Research paper on **“Material Handling Equipment”**
“Time and place utility” Material Handling only adds to the cost of a product. It Determine Technical Feasibility and also Determine Economic Feasibility.
8. Research paper on **“Automated Guided Vehicle”**
The paper attempts to study the guidance of Automated Guided Vehicles (AGV) . AGVs are driverless vehicles which operate on batteries on a predefined pathway. This will provide a path to innovating and challenging role of Manufacturing Engineers in the field of Material Handling.
Thus Automated Guided Vehicles serves greatest benefits in the field of Material handling. In future, research may be undertaken to make AGV feasible for small scale industry also.
9. Research paper on **“Automated Guided Vehicle Systems: a Driver for Increased Business Performance”**

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The automation of transportation in the production, trade and service sector is a key point in the optimization of logistics. This paper provides an overview on AGVS technology, points out recent technological developments.

Long-term export possibilities for AGVS-manufacturers are of particular interest.

III. COMPONENTS

1. Chassis(e) :-

Material :- Mild Steel
Dimension :- 2.5X2X3 ft
Weight :-15 kg



(e)

2. Mechanical Jack(f) :-

Lifting Height :- 1.2 ft
Cost :- 900 INR
Type :- Steel Scissor Jack
Lifting Height :- 1 ft



(f)

3. Motor(g) :-

Type :- Johnson motor
RPM :- 20 and 30 rpm



(g)

4. Guide ways with bearing(h) :-

Material : Stainless Steel
Length : 2.5 ft



(h)

5. Driver Circuit(i) :-

Type :-Relay Driver and Controller Based
Wireless Circuit
Connectivity :- Wireless (Bluetooth)



(i)

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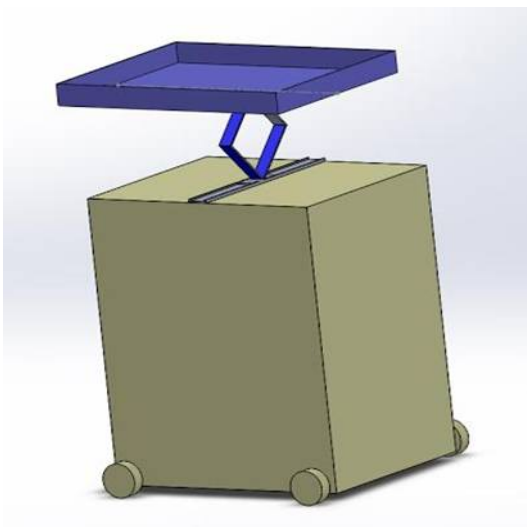
IV. ANALYSIS

Speed Calculation :-

Rotational Velocity(ω) :- 30 rpm

Radius of wheel(r) :- 0.05 m

$$V = r \times \omega = 0.157 \text{ m/s}$$



(j)

Force Calculation :-

Size Of Chassis : 2.5 x 2 x 3 ft

Lifting Height : 3 ft (min) to 4 ft (max)

Weight Carrying Capacity : 30 kg

Weight Of Material Handling Equipment : 20 kg

Speed Of Material Handling Equipment : 0.157 m/s

Total Force : $m \times g = 50 \times 9.81 = 490.5 \text{ N}$

Force Per Wheel : $F/6 = 81.75 \text{ N}$

Cost Analysis :-

Chassis Cost - 3200 INR

Johnson Motor - 600 X 5 = 3000 INR

Mechanical Jack - 900 INR

Guide-ways - 1600 INR

Battery - 2500 x 2 = 5000 INR

Powder Coating - 2500 INR

Circuit - 3300 INR

Wheel - 125 x 6 = 750 INR

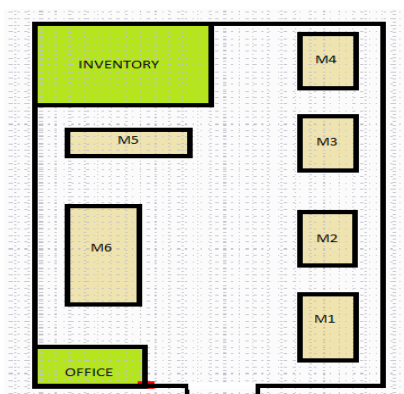
Total Cost :- 20300 INR

Maintenance Cost : 10 % of total cost

V. SIMULATION AND RESULT

We have tested our material handling equipment at Maruti Grinding Works situated at Makarpura G.I.D.C.

Plant Layout(k) & Travelling Diagram(l) :-



(k)



(l)

For Production Cycle-1:- Initial point-M1-M2-M3-M4-Inventory

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Movement	Distance (ft)	Waiting time (sec)	Time taken by MHE (sec)	Time taken by manual handling (sec)
Initial point-M1	6	15	12	20
M1-M2	14	15	29	37
M2-M3	14	15	29	37
M3-M4	14	15	29	37
M4-Inventory	6.5	15	14	22

For Production Cycle-2:- Initial point-M6-M5-Inventory

Movement	Distance (ft)	Waiting time (sec)	Time taken by MHE (sec)	Time taken by manual handling (sec)
Initial point-M6	17	15	33	41
M6-M5	16	15	31	39
M5-Inventory	19	15	37	45

VI. CONCLUSION

From all these results, it can be concluded that the material handling equipment reduce material handling time as well as cost. we can achieve safety of material handling and reduce man power. thus productivity of industry will increase.

Following is an result of main benefits of using material handling equipment:-

- Reduces cost of material handling by 30%
- Reduces total time consumption by 19.5%
- Improve the quality of material handling
- Safety of human
- Increase the productivity

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