IMPLEMENTATION OF AN AUTOMATIC STORAGE & RETRIEVAL SYSTEM.

[1]Krishna Gutte , [2]Yash Gupta,[3]Parag Manval,[4]Pradeep Jadhav,[5]Prof.Atul N Gowardipe

[1,2,3,4]Students Of Mechanical Engg. ,[5]Professor Of Mechanical Engg.

[1]Department Of Mechanical Engineering

[1]Dr.D Y Patil School Of Engineering and Technology, Lohgaon , Pune, India-412105

Abstract: This Project deals with the applicability of Automatic Storage & Retrieval System which maximise quantity of product store in the system that are used for the storage and retrieval of product in both distribution and production environments. Automatic Storage & Retrieval System are composed of motor, chains, working table that are attached on a shuttle carrier, shelves, programmable logical controller based control system and storage racks.

Automatic Storage & Retrieval System Increase the throughput capacity of the product as compared to conventional storage system. This system has very benefit such as saving in labor cost ,improved material flow ,increase productivity better space utilization, safety and ergonomic ,optimized load balancing ,maintenance cost also low. By using this system in the company then production rate is increases.

I.   INTRODUCTION

In this scenario industry need higher production rate so to minimize the some drawback like larger floor space ,picking rate of product, time required for assembly then this new concept are introduced known as Automatic Storage & Retrieval System. The large floor space is occupied in the company, then the new concept invented in 1898 by Sir. James Henry Rand was designed steel cabin to store index card make them easier to sort an access.

He founded the American kardex company in 1915. This company made the kardex shuttle system also known as Automatic Storage & Retrieval System. It is the type of automated storage and retrieval system .This system is defined as the storage system that uses fixed path storage and retrieval machine running on one or more rails between fixed arrays of storage racks.

It is used for distribution and production environment and ware house system to store and retrieve unit loads without interference of an operator. Today's world of rapidly changing customer demands , small internet order ,tight delivery schedules , high competition and high service level requirements then that condition are satisfied so this new system is introduced .

The main advantages are saving in labor cost and floor space, increased production rate. To meet this demand in throughput capacity and constraint with regards to delivery times in storage system are developed in automated material handling industry. In general compact storage system are popular for storing product with relatively low unit load demand and characterized by high space efficiency. The concept adopted for this project is the Kardex shuttle concept, which is generally used for inventory management.

It can be defined as modular structured computer managed robotic vertical lift, storing along with the recovery system. Every part works with its own computer and electronically managed extractor which moves and provides the required tray or bucket to the small entrance of the location allocated for its storage in a very small duration of time. All the materials are stored on the plates or trays on the forward facing and backward facing side of the tower. This kardex shuttle extractor does the work of getting the required material from their storage location to the trays and placing the material back to its previous location after use.

In conventional system product are stored on a pallet or rack then this system increases the large floor space area also the picking of any product is time consuming process also production rate of company reduces. To minimize the drawbacks of conventional system Automatic Storage & Retrieval System is used.

II. PROBLEM STATEMENT

We have done project on "Automatic Storage & Retrieval System" for the application of storage any component in a industry like screw, nut, plastic component, piston rod etc.

Objectives
- To Increases space efficiency of conventional storage system.
- To Increases the production rate of industry.
- To improve inventory managements
- To reduce the labor cost and maintenance cost.
- To develop this system with better design flexibility and performance

III. METHODOLOGY

In every company the main issue faced is space management on the shop floor. The area available is to be utilized for material storing as well as the production of the machine, both are required to be on the same floor so that this system is installed in the company. This system requires less floor space area then time requirement for moving the material to required site is less and production rate is higher.

After the floor area was studied, the next task was to find out the Kanban quantity. This was done to make sure, the flow of material is right in time and the production should not get affected due to any kind of delay in the availability of the material. For deciding the Kanban system, the two bin system is followed. The quantity of material in each bin is to be calculated and accordingly the order is needed to be placed. For calculating the quantity, the parameters required are lead time, monthly production, the daily requirement of the material.

There were various machines and companies that provide this kind of machines. It is made to the requirement of the company, the height, width, placing on the shop floor. This concept makes the storing of material having different sizes possible. The material can vary from smaller parts to the material on the trays in one entire single unit. It benefits to improve the working techniques in the storerooms or warehouses.

With the help of good motor, the initiating and stopping of the extractor and trays becomes very smooth and jerk free. Addition of the speed controller feature make starting and stopping routine more reliable and smooth by managing and transporting speed and also change the situation of the changing load strain. This is ensured the time required for transporting also reduced.

IV. CONSTRUCTION

Automatic Storage & Retrieval System is composed by motor, motor shaft attached driving gear, chain bucket mechanism, driven gear, rack or shelves, axle shafts, casing or enclosure, Arduino control system, display Numeric panel. The main part of the system is motor and Arduino controller is the brain of vertical stacking system. Motor is having high duty load carrying capacity to minimize the losses in the vertical stacking system the construction of vertical stacking system as shown in figure 1
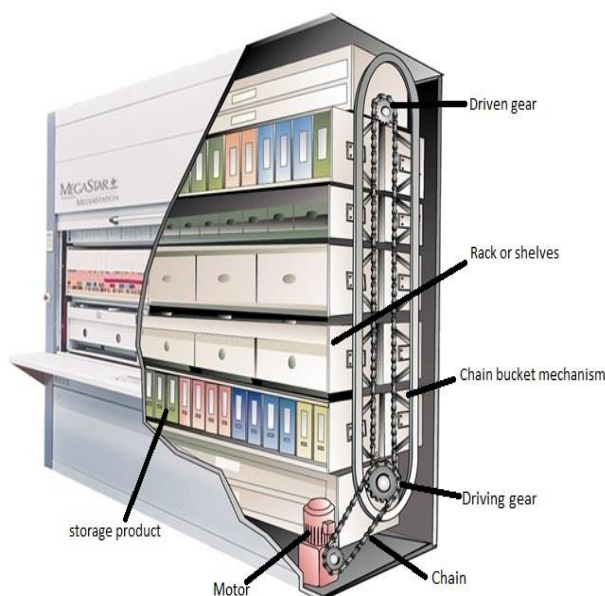
Fig 1.Construction of vertical stacking system

V. WORKING

The working of Automatic Storage & Retrieval System is based on mechanical arrangement of that system .When electric supply is provide to motor rotates driving gear are rotated. By rotating the driving gear as well as driven gear shaft rotated with the help of chain drives .So driven gear shaft is connected through chain bucket mechanism that are with shelves. Working of chain bucket mechanism then rotating of shelves moving upward or downward direction with the help of Arduino control panel. By putting some command in numerical control display unit the working of system is done. In Arduino program are stored which type of product placed in a rack number.

So it is easily to sort and access the material to reduce the time search of product which place is stored. Every part works with its' own computer and electronically managed extractor which moves and provides the required tray or bucket to the small entrance of the location allocated for its storage in a very small duration of time. All the materials are stored on the plates or trays on the forward facing and backward facing side of the tower.

Parts of Automatic Storage & Retrieval System
- Motor
- Chain Bucket mechanism
- Shelves or Racks
- Arduino
- Numerical Control Display unit
- Driving and driven member

Block Diagram of Vertical Storage System:-
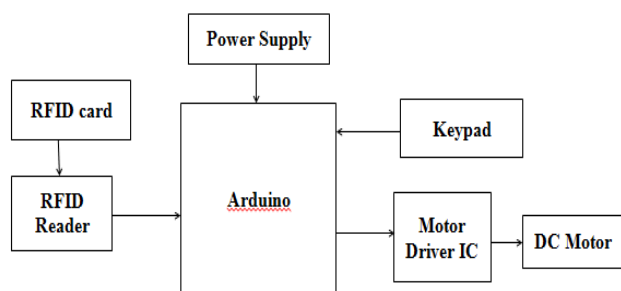
1. Arduino

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

2. RFID Reader Module

This is a low frequency (125Khz) RFID reader with serial output with at range of 8 to 12cm. It is a compact units with built in antenna and can be directly connected to the PC using RS232 protocol.

Fig2. RFID Reader Module

3. DC motor

Japan Servo's DC Miniature Motors are widely used in a variety of application fields, from copiers and other office equipment, to remote-controlled equipment, medical equipment, vending machines, and game machines. These motors may be combined with Japan Servo's full line of gear heads to meet a wide range of torque and output speed specifications. Japan Servo provides a practical and economic choice as drive actuators. Strict quality control ensure reliable performance as well as prompt delivery at reasonable price. Japan Servo provides a full variation line-up of stock model and customized design motors to best meet your specific application needs.
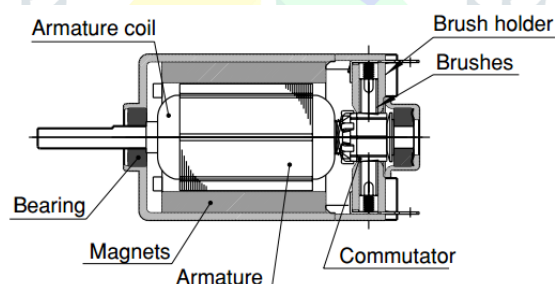

Fig 3. DC motor

4. 4x4 Matrix Membrane Keypad

This 16-button keypad provides a useful human interface component for microcontroller projects. Convenient adhesive backing provides a simple way to mount the keypad in a variety of applications.

Fig 4. 4x4 Matrix Membrane Keypad

VI. **How it Works**

Matrix keypads use a combination of four rows and four columns to provide button states to the host device, typically a microcontroller. Underneath each key is a pushbutton, with one end connected to one row, and the other end connected to one column.
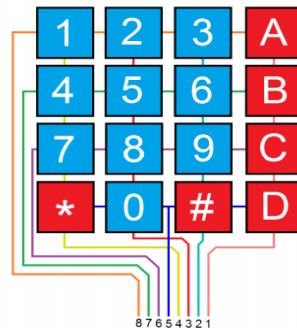
Fig5. matrix keypad connections

In order for the microcontroller to determine which button is pressed, it first needs to pull each of the four columns (pins 1-4) either low or high one at a time, and then poll the states of the four rows (pins 5-8). Depending on the states of the columns, the microcontroller can tell which button is pressed. For example, say your program pulls all four columns low and then pulls the first row high. It then reads the input states of each column, and reads pin 1 high. This means that a contact has been made between column 4 and row 1, so button 'A' has been pressed.

VII. FUTURE SCOPE

By using Automatic Storage & Retrieval System in the industry, then the better space utilization is done in the industry also the 50% space is utilized in industry. The remaining space is use for any other work useful for like material storage, assembly of any machine so it increases the production rate of company at desired level. Order picking of product of company also increases; faster delivery of product is done. Safety of store product is also done in the Automatic Storage & Retrieval System.
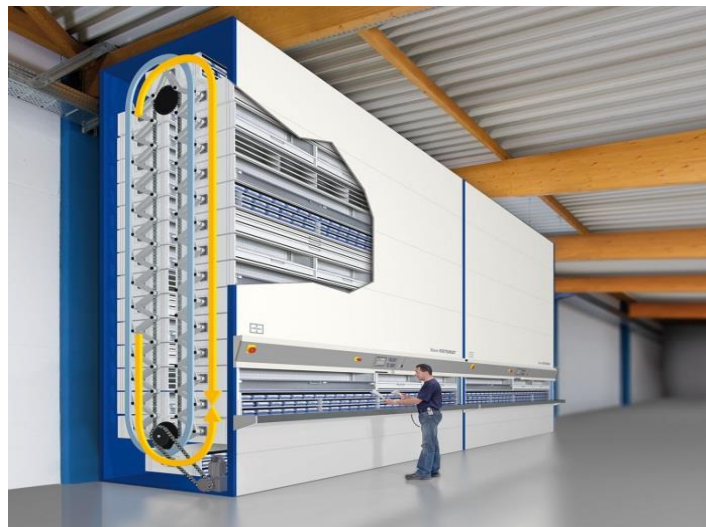
Fig 6.Conventional storage system
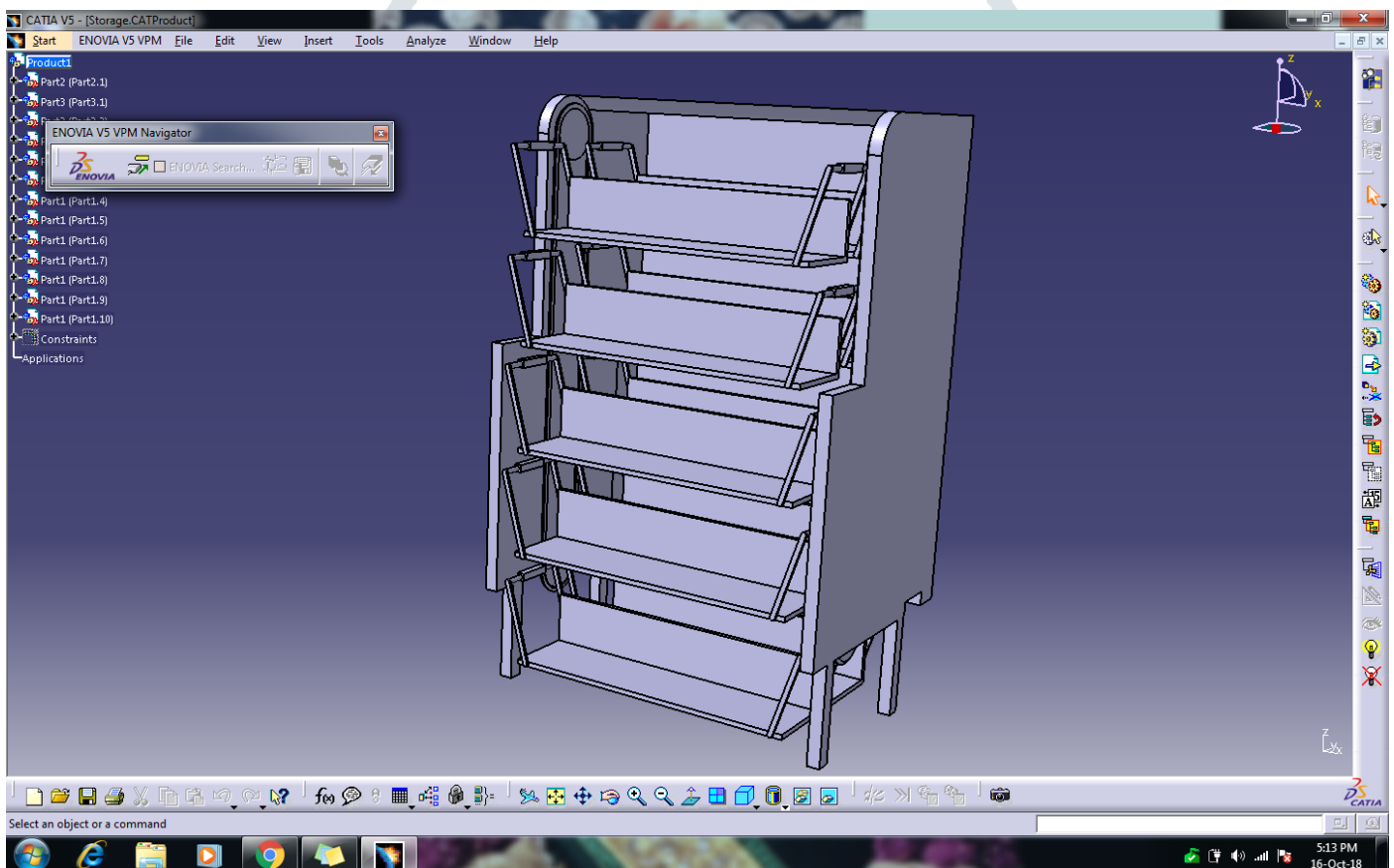
Fig 7.Automatic Storage & Retrieval System

Fig.8.Catia Modelling of Automatic Storage & Retrieval System

VIII. ADVANTAGES

- Optimize the load balancing.

- Maximum weight of product is stored.

- Better Space Utilization.

- All available vertical height is utilized, reducing floor space requirements.

- Product Pick Rate is higher.

- Better Environmental Control- For example, product inside a vertical stacking system will be protected from dust or other contaminants.

- Increase productivity Rate Materials are delivered directly to operator, minimizing walking, climbing, bending or reaching for heavy objects.

- Space Utilization All available vertical height is utilized, reducing floor space requirements.

- Work place ergonomics enhancements.

- Accurate inventory control.

- Expandable storage options.

IX. CONCLUSION

In this project it is observed that the area required of Automatic Storage & Retrieval System is less as compare to conventional storage system, so improving the space efficiency of any company. Automatic Storage & Retrieval System has very high throughput capacity or maximum amount of material store in this system. Also the maximum weight capacity of material is used in this system. As per calculations and result by using this system company production rate are increases at desired level. Also picking rate of product and faster delivery is done in this system. The system is a great improvement for the materials handling systems.

It increase customer delivery yields and to grow overall as a company. It was opportunity for growth and chose the right system, which aligned with the corporate goals of the company. When the Automatic Storage & Retrieval System was introduced, with some amount of investments, it was possible for the company to increase their production rate of company. This is also help to increase their sales accordingly. This system increases the throughput capacity of the system.

X.   REFERENCES

[1] Pooja C. Patil, Abdul Samad , Dr.Y.B.Mathur : "Optimizing Assembly Rate by Managing Space and Introducing Vertical Storage System", International Journal of Emerging Technology and Advanced Engineering ,Research and technology,(ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 5, Issue 11) [2015].

[2] Kalyanaraman.P, Keerthika.C:"A Review on Automated Storage/ Retrieval Systems and Shuttle Based Storage/Retrieval Systems", International Journal on Recent and Innovation Trends in ComputingandCommunication Volume: 4 Issue: 11 (ISSN: 2321-8169) [2014]

[3] Y. B. Mathur,Pooja.c.Patil, Abdul Samad:"Increasing the Production Rate by Introducing Vertical Storage Machine",International Journal of Current Engineering and Technology, E-ISSN 2277 – 4106, P-ISSN 2347 – 516, Volume 6 [2016]

[4] Antonio Gabriel-Santosa, Joao Rollab, Alberto Martinhoa, Joao Fradinhoa, Antonio Goncalves-Coelhoa & Antonio Mouraoa : "The rational footsteps for the design of the mechanism of a vertical carousel-type storage device" , Procedia CIRP 193 – 197, Volume 53 [2016]

[5]Rene de Koster1, Tho Le-Duc, Kees Jan Roodbergen : "Design and control of warehouse order picking: a literature review", European Journal of Operational Research 182(2), 481-501,Volume 2 [2007]