



Automation of shops using robots

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Abstract: - In this paper we have explained the design, fabrication and working of our shop automation robot, which is an extremely new idea for automation of shop floor. This robot will be highly helpful in saving consumer's time which is wasted for purchasing for his needs and also arranging things in a shop. This automated purchase vehicle will purchase a list of things specified by the customer through a computer and delivers it in few minutes. Time which is saved can be used for various other useful works such as gym, yoga or in beauty parlors.

Introduction

We felt that men are wasting lot of time for purchasing their daily needs in bazaars and also the shop keepers spend more time in arranging things in their specified places. So we are introducing an idea of using a robot which will purchase everything that a customer specifies and arranges things in its place when no work is allotted. This time which is saved by these automatic purchase robots may be usefully spend by the customers in the gym or in beauty parlors and other useful work. Our robot is made of a chassis which is similar to the trolley and this chassis is motorized for locomotion. Our robot is basically a line follower, and the path and the position of items is specified in the lines. For the purpose of picking and placing the required materials there are two pick and place robotic arms. These loads the robot with the things required rapidly as soon as the robot stops at the specified position.

Arranging of item

During nights and when the robot is free it can be switched to arranging mode. Turning to this mode will make the robot to go to godown and load the specified items and arranges the items in the racks inside the shop in a quick way.

Specifications

Chassis- Stainless steel- 120*75*120 mm
 Motor - Wiper motor – 12v, 100 rpm, 80 kg cm torque.
 Air compressor-0.22 kW – 33 lpm – 2880 rpm.
 Robotic arm- Two pick and place arm (one hand type and other suction cup type)
 Batteries - 12v, 2*32 Ah, lead acid batteries.
 Wheels - High weight carrying alloy wheels.

Locomotion

Our robot is actually a line follower which follows a line of 3/4". This line will take the robot through the racks where the items are arranged. There will be cross lines on the follower line where the robot has to stop and the robotic arm will pick the material and place in the chassis. The robot will stop at places which the programmer specifies and skips the position where it is not specified.

Prevention of hitting persons

In case if there is a person or some obstacle in the path of the robot, sensors in the front detects it and asks to move by giving some beep sound. If the person or object remain there for more than 15 seconds then it alarms the shop keeper to clear the obstacle. Most probably there is no chance of such a happening as the store is fully automated.

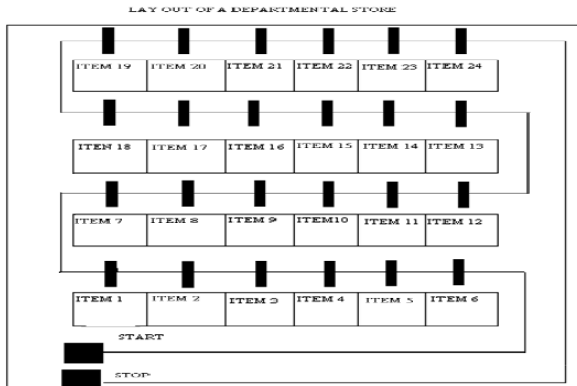


Figure: 1 Layout of Departmental store

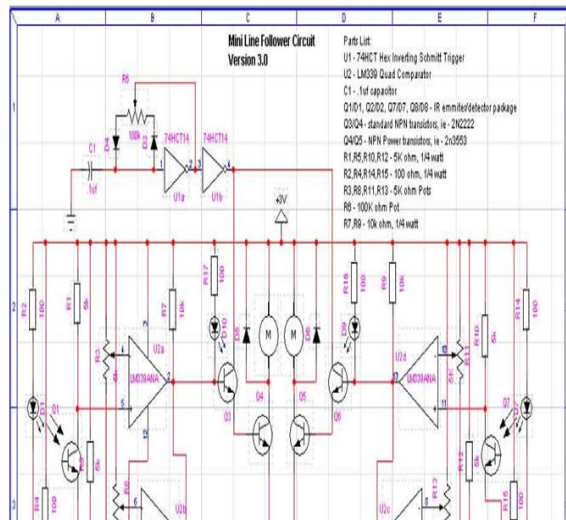


Figure: 2 Mini line floor



Figure: 3 IR Sensor

Robotic arm

There are two robotic arms which does the work of purchasing. One arm is hand type and another arm consists of vacuum cup which is connected to a small compressor. These two arms does the purchase operation rapidly. Both the arms are powered by servo motors of very high torque. So these arms can pick and place a weight of about 20 kgs.

Robotic arm’s load capacity

Arm 1

These robotic arms are made of hard stainless steel and high torque servo motors. These arms are capable of lifting large loads of around 20 kgs. These arms are highly precession in nature, which picks and places the objects accurately.

Arm 2

This arm consists of a suction cup, which is connected to the compressor. This cup when placed on a particular thing, it creates vacuum and holds the object tightly. This object is then moved to the chassis and the vacuum is released. This arm can also move a load of 15 kgs to chassis.



Figure: 1 Robotic arm

It is almost unimaginable that a screw air compressor with rotors of diameter 28 mm and 35mm can give an output of compressed air ranging from 1 to 300 lpm. Besides the range of compressed air output, the Compressor's other desirable characteristics include high efficiency, low noise, and high reliability. Ideally this compressor is designed to give 33 lpm of compressed air at a rotor speed of 2880 rpm, with a power consumption rate of just 0.22 kW. The Compressor can also be applied for heavy-duty applications with rotor speeds of up 20,000 rpm, producing proportionally larger volumes of compressed air. These two arms are highly précised, and perform the purchase as quick as possible and even it can be used for arranging the materials in to the shelves.



Time calculation

Considering that the total distance travelled by the robot for covering total length of the line= 250 m

Motor speed (Revolutions perSecond)

=100 rpm

Diameter of wheel =150 mm

Circumference of wheel

= πd

= 3.14×150

=471.238 mm

For one minute it can cover a distance of

= 471.238×100

=47.124m.

So, total distance of 250m can be covered in

= 5.305 min.

Time taken for pick and place robot to

Perform their operation for 10 items

= 5 min

Total time taken for purchasing 10 items is

= 10 min (approximate)

If a person performs this operation it may take more time than this. More over robot knows the place where the specific item is stored. So there is no need for searching of things. These calculations show that this robot is better to be used.

Load carrying capacity

Torque capacity of a motor

-80 kg cm/ motor

Four motors for each wheel will drive

= $4 \times 80 = 320$ kgs

Self weight of the chassis

- 20 kgs

So, the robot can drive o load of

- $320 - 20 = 300$ kgs

This calculation shows that these robots can be loaded up to 300 kilograms of materials in it, which is more than enough for purchasing a large number of house hold materials.

Power for locomotion

The power supply lines are laid on the floor in depth of about 20mm which keeps the robot in contact with the supply line through a sliding contact and the transformer in it step downs 230v to 12v for locomotion. In case of emergency Lead acid secondary batteries are used. This supply path is embedded along with line follower.

Advantages

1. Automation of departmental shops, hard ware stores,etc.
2. Reduction in man power.
3. Reduced time consumption.
4. Indication when a specified item goes beyond minimum quantity.
5. Shock proof power supply lines.
6. Conventional battery source in case of low voltage.

Disadvantages

1. Can be used only in big supermarkets where things are arranged in proper order and covered.
2. High initial cost.

Conclusion

We ensure that our robot will play a vital role in the field of automation reducing the human labour, precious time, manual error,etc. We hope that further studies on this automation by us will rectify the disadvantages and improves the performance.



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