© 2017 IJSRSET | Volume 3 | Issue 2 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Glass Wall Climbing and Clean-up Automaton

Suryakant Rathod, Ankur Rai, Chandan Kumar, Raj Kumar
Mechanical Engineering, DYPCOE, Ambi, Pune, Maharashtra, India

ABSTRACT

The purpose of this study is to develop the wall rising automaton for cleanup one massive windowpane like a show window. It needs the subsequent demands to use the window cleanup automaton for the sensible use: 1) Adhere or stick the automaton to the glass surface with the assistance of suction cup vacuum. 2) Clean the glass surface of the window with facilitate of wiper hooked up to the front panel of the automaton. 3) Once cleanup off wiper & then climb (walk) the automaton as per instruction to the microcontroller. For adhesion of automaton to a surface, we've seen the various variety of adhesion technique like adhesion by magnetic attraction, adhesion by small spine etc. But, here we have a tendency to develop Elecrochuks (Creation of vacuum in a suction cup by using injection syringe operated by D.C.Motor) to get adhesion of automaton. Elecrochuks are just like suction cup during which needed vacuum is formed by actuation a connecting rod from the cylinder like structure mounted on a suction cup. The scale of the model is just about 690 millimeter times 400 millimeter times 160 millimeter and its weight is around less than 3 kilogram.

Keywords: Suction cups, Microcontroller, D.C.Motor, Climbing Robot, vacuum adhesion

I. INTRODUCTION

In our introduction to Wall rising automaton we've some background history of all types of Wall rising Robots, & secondly the aim of our work.

A. Background

Rising robots are helpful devices which will be adopted in a very type of applications like maintenance, building, scrutiny and safety within the method and construction industries. These systems are primarily adopted in places wherever direct access by an individual's operator is extremely costly, due to the necessity for the system, or terribly dangerous, because of the presence of hostile surroundings. .Recently, there are several demands for an automatic clean-up system on outside surface of buildings like a pane of glass by increasing of recent architectures. Some customized window clean-up machines have already been put in into the sensible use within the field of building maintenance. However, nearly of them are mounted on the building from the start and that they desire terribly costly prices. Therefore, necessities for tiny, light-weight and transportable window clean-up automaton also are growing within the field of building maintenance.

As the results of measuring the necessities for the window clean-up automaton, the subsequent points are necessary for providing the window clean-up automaton for sensible use:

- It ought to be a tiny size and light-weight for movability.
- Automatic operation throughout moving.

A wall rising automaton ought to be lightweight and permit an oversized payload, reducing excessive adhesion forces and carrying instrumentations throughout navigation. Up to now, a significant analysis was dedicated to these machines and numerous kinds of experimental models were projected. The two major problems within the style of wall rising robots are their locomotion and therefore the adhesion strategies. With reference to the locomotion type, 3 varieties are usually considered: the crawler, the wheeled and therefore the legged varieties. Consistent with the adhesion technique, these robots are usually classified into 3

groups: vacuum or suction cups, magnetic, and gripping to the surface. Recently, new strategies for reassuring the adhesion, primarily based on biological findings, have additionally been projected [1].

B. Aim of work:

The study and production of automatons for the domestic application may be a comparatively recent analysis field. This type of automaton is really in continuous development. Large surface clean-up and even glass windows or building walls are on the study in industrial fields with terribly completely different characteristics and innovations [2] [4]. Our target is to make a wall-climbing automaton for window clean-up application. The Wall rising automaton having capability that it will stick on a vertical furthermore as an inclined surface and might simply give way the surface. The targeted capability to stay with the surface will be achieved by suction cups. Suction cups produce a vacuum pressure used to stick to the vertical or inclined surface. For movement (climbing) of an automaton, it's necessary that a suction cup ought to unleash & that arrangement is obtained by developing the structure specified during which one frame is employed to carry the automaton to wall & alternative for rising.(vertical movement of automaton) .The motion of the other frame is meted out by providing rack & pinion kind mechanism [5].

The whole process is under control of an 8bit microcontroller.

The clean-up process of the glass surfaces will be achieved by attaching a windscreen wiper kind of structure to the front panel of an automaton.

In this paper, Section II reviews the mechanical structure of clean-up automaton. List of components used in clean-up automaton is given in Section III. Section IV gives the specification and details of components used and Section V discusses conclusions and finally acknowledgment & references.

II. MECHANICAL STRUCTURE OF CLEAN-UP AUTOMATON

The clean robot is autonomous wall rising automaton, that uses lighter body materials and completely different walking/climbing mechanisms than those employed in robots according to earlier Consequently, with considerably improved sensible robotic feet (SRF), this new automaton is quicker, lighter and smaller that according to earlier [3]. The new SRF is supplied with a 50-millimeter diameter suction cup, motor, a pressure sensing element and a micro-valve. The whole system operates by control of one programmable microcontroller and may be supercharged by a 6-volt thin cell lithium battery pack mounted on-board, creating the automaton entirely autonomous. A Wall rising automaton having capability that it will stick on a vertical also as an inclined surface and may simply move the surface. The targeted capability to stay with a surface is achieved by suction cups. Suction cups produce a vacuum pressure accustomed stick to the vertical or inclined surface. Electrostatic Chucks produce a controlled adhesion by means that of some building block or charged force. The movement on the surface is achieved by stepper motor wheel or a balanced movement of suction cup legs. The complete action is controlled by an 8bit 8051 Microcontroller.

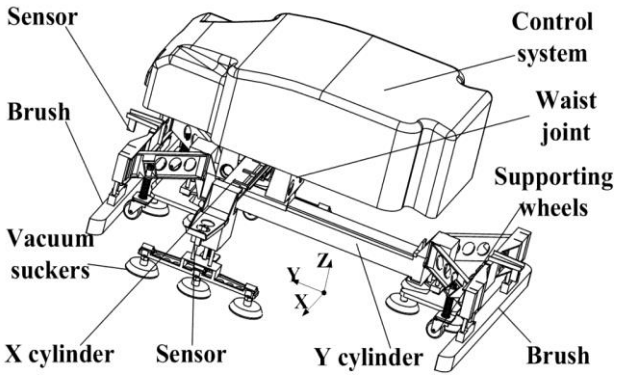

Figure 1: Structure of Clean-up Automaton

III. COMPOENTS USED IN CLEAN-UP AUTOMATON

The major elements required for creating the desired automaton are as:

1. Microcontroller
2. Suction Cups
3. DC motor
4. Robot legs and accessories
5. Chassis for robot
6. DC Motor Driver IC
7. Power and Voltage regulating ICs
8. Power and connecting cables
9. Injection Syringe

IV.SPECIFICATION AND DETAILS OF COMPONENTS USED IN AUTOMATON STRUCTURE

A. Suction Cups:

There are eight suction cups are need. And out of that four on inner frame and four on the outer frame. Suction cups used for the developed automaton are of ESS50-FESTO kind (with an outer diameter of 50 mm).

Table 1: Specifications

Property	Value
Design structure	Vacuum connection at top
Design structure	round, standard
Ambient temp	-20 - 60 °C
Operating medium	Atmospheric air
Symbol	00991485
Breakaway force at 70% vacuum	106 N
Shore hardness	62
suction cup diameter	50 mm
Mounting thread	G1/4
Vacuum connection	G1/4
suction cup mounting	G1/4
Product Type	Festo Suction cup VAS VASB
Effective suction diameter	44 mm
Materials information for screw-in stud	Zinc die-casting
Materials information for suction cup	TPE-U(PU)

B. Types of Power Supply

There are many varieties of a power supply. Most are designed to convert high voltage AC mains electricity to an appropriate DC voltage supply for electronic circuits and alternative devices. A power supply will by counteracted into a series of blocks, every of that performs a specific function.

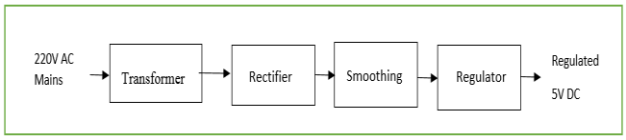

Figure 2: Block Diagram of Regulated Power Supply

C. Electrolytic Capacitors

Figure 3: Electrolytic Capacitors

D. Voltage Regulator

Voltage regulator ICs are in the market with mounted (typically 5, 12 and 15V) or variable output voltages. They're conjointly rated by the maximum current they will pass. Negative voltage regulators are in the market, primarily to be used in dual supplies. Most regulators embrace some automatic protection from excessive current ('overload protection') and heating ('thermal protection'). Several of the mounted voltage regulator ICs has 3 leads and appearance like power transistors, like the 7805 +5V 1A regulator shown on the right. They embrace a hole for attaching a heat sink if necessary.

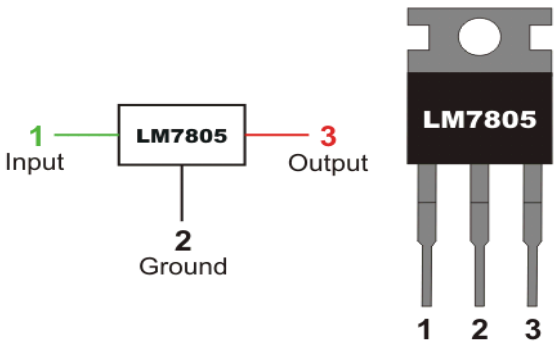

Figure 4: Voltage Regulator

E. Microcontroller

Features-

- 64 KB flash memory
- 1 KB RAM
- 32 I/O lines
- Programmable counter array
- In System Application
- Three 16-bit Timer/Counter

Figure 5: Microcontroller

F. D.C. Motor

A DC motor may be an automatically commutated motor powered from DC. The stator is stationary in the area by definition and so is its current. The current within the rotor is switched by the commutator to even be stationary in the area. This is often, however, the relative angle between the stator and rotor magnetic flux is maintained close to 90 degrees, that generates the maximum force. DC motors have a rotating armature winding, however, nonrotating armature magnetic flux and a static field winding or magnet. Completely different connections of the sphere and armature winding give different inherent speed/torque regulation characteristics. The speed of a DC motor will be controlled by ever-changing the voltage applied to the armature or by ever-changing the field current. The introduction of variable resistance within the armature circuit or field circuit allowed speed management. Trendy DC motors are usually controlled by power electronics systems referred to as DC drives. The introduction of DC motors to run machinery eliminated the necessity for native steam or combustion engines and line shaft drive systems. DC motors will operate directly from rechargeable batteries, providing the locomotion for the primary electrical vehicles. Nowadays DC motors are still found in applications as little as toys and disk drives, or in massive sizes to control steel rolling mills and paper machines.

V. CONCLUSION

This study presents an application of a rising automaton for the glass and wall clean-up service. The automaton is built by using 2 frames, Suction cups & Motor, Injection barrel automaton having capability that it will stick on a vertical also as an inclined surface and may simply ease up the surface. The targeted capability to stay on the surface is often achieved by suction cups. Suction cups produce a vacuum pressure used to keep on with the vertical or inclined surface. Future work is going to be toward developing a lot of efficient motion system and reducing size/weight of the rising automaton.

VI. ACKKNOWLDGMENT

We are thankful to faculty of Mechanical Engineering Department, DYPCOE, Savitribai Phule Pune University for their support. The product of this research paper would not be possible without all of them.

VII. REFERENCES

[1] N. R. Kolhalkar, S.M.Patil, "*A Review on climbing robot*," International Journal of Engineering and Innovative Technology (IJEIT) Volume 1, Issue 5, May 2012.

[2] Guido Belforte, Roberto Grassy, "*Innovative solution for climbing and cleaning on smooth surfaces*."

[3] Tohru Miyake, Shunichi Yoshida, "*Development of small-size window cleaning robot by wall climbing mechanism, Third Int'l conf. On Climbing and Walking Robots*," pp. 789-794, 2000.

[4] Zhang H., Zhang J., Liu R., Wang W. and Zong G,.2004, "*Pneumatic Climbing Robots for Glass Wall Cleaning*," Proc. of the 6th International Conference on Climbing and Walking Robots, pp. 1061-1069.

[5] Zhu, J., Sun, D. and Tso, S. K, 2001, "*Development of a Tracked Climbing Robot*," Journal of Intelligent and Robotic Systems, Vol.35, 427-444.