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Programmable Surface Cleaning Robot

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Abstract-- The purpose of the present study is to develop the wall climbing robot for cleaning a single large windowpane such as a show window. It requires the following demands to apply the window cleaning robot for the practical use: 1) adhere or stick the robot to glass surface with the help of suction cup vacuum .2) Clean the glass surface of window with help of brush attached to the front panel of robot.3) After cleaning off with the brush,then climb (walk) the robot as per instruction given in the arduino board.

For adhesion of robot to surface we have seen different type of adhesion technique like adhesion by magnetic force, adhesion by micro spine etc. But, here we create a vacuum in suction cup to obtain adhesion of robot. The dimensions of prototype are approximately 690 mm times 400 mm times 160 mm and its weight is approximately not more than 3 kg.

Keywords:- Suction cups, Arduino Board, D.C.Motor, Climbing Robot, vacuum adhesion.

I. INTRODUCTION

In our introduction to Wall Climbing Robot we have some background history of all kinds of Wall Climbing Robots, & secondly the purpose of our project.

Climbing robots are useful devices that can be adopted in a variety of applications like maintenance, building, inspection and safety in the process and construction industries. These systems are mainly adopted in places where direct access by a human operator is very expensive, because of the need for scaffolding, or very dangerous, due to the presence of an hostile environment. .Recently, there have been many demands for automatic cleaning system on outside surface of buildings such as window glass by increasing of modern architectures. Some customized window cleaning machines have already been installed into the practical use in the field of building maintenance. However, almost of them are mounted on the building from the beginning and they needs very expensive costs. Therefore, requirements for small, lightweight and portable window cleaning robot are also growing in the field of building maintenance.

As the results of surveying the requirements for the window cleaning robot, the following points are necessary for providing the window cleaning robot for practical use:

• It should be small size and lightweight for portability.

• Automatic operation during moving. A wall climbing robot should be light and allow a large payload, reducing excessive adhesion forces and carrying instrumentations during navigation. Up to now, considerable research was devoted to these machines and various types of experimental models were proposed. The two major issues in the design of wall climbing robots are their locomotion and the adhesion methods. With respect to the locomotion type, three types are often considered: the crawler, the wheeled and the legged types. According to the adhesion method, these robots are generally classified into three groups: vacuum or suction cups, magnetic, and gripping to the surface. Recently, new methods for assuring the adhesion, based in biological findings, have also been proposed.

The study and production of robots for domestic application is a relatively recent research field. This kind of robot is actually in continuous development. Huge surface cleaning, and even glass windows or building walls is on study in industrial fields with very different characteristics and innovations. Our target is to build a wall-climbing robot for window cleaning application. The Wall Climbing Robot (WCR) having capability that it can stick on a vertical as well as inclined surface and can easily move over the surface.The targeted capability to stick with surface can be achieved by suction cups. Suction cups create a vacuum pressure used to stick with vertical or inclined surface. For movement (climbing) of robot it is necessary that some of suction cup should release & that arrangement is obtained by developing the structure such that in which one frame is used to hold the robot to wall & other for climbing.(vertical movement of robot) . [3] proposed a principle in which another NN yield input control law was created for an under incited quad rotor UAV which uses the regular limitations of the under incited framework to create virtual control contributions to ensure the UAV tracks a craved direction. Utilizing the versatile back venturing method, every one of the six DOF are effectively followed utilizing just four control inputs while within the

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sight of un demonstrated flow and limited unsettling influences.

Cleaning action of the glass surfaces can be achieved by attaching a wind screen wiper type of structure to front panel of robot.

II. MECHANICAL STRUCTURE OF CLEANING ROBOT

Clean robot is autonomous wall climbing robot, which uses lighter body materials and different walking/climbing mechanisms than those used in robots reported earlier Consequently, with substantially improved smart robotic feet (SRF), this new robot is faster, lighter and smaller that that reported earlier The new SRF is equipped with a 50 mm diameter suction cup, electric motor, a pressure sensor and a micro-valve. The entire system operates by control of a single programmable microcontroller, and can be powered by a 6-volt thin cell lithium battery pack mounted onboard, making the robot totally autonomous.

The Wall Climbing Robot (WCR) having capability that it can stick on a vertical as well as inclined surface and can easily move over the surface. The targeted capability to stick with surface can be achieved by suction cups . Suction cups create a vacuum pressure used to stick with vertical or inclined surface. Electrostatic Chucks create a controlled adhesion by means of some intermolecular or charged force. The movement on the surface can be achieved by stepper motor wheel or a balanced movement of suction cup legs.

III. COMPONENTS USED IN CLEANING ROBOT

The major components required for building targeted robot are as follows:-

1. Suction Cups
2. DC motors.
3. Robot legs and accessories.
4. Chassis for robot.
5. Power and Voltage regulating ICs.
6. Power and connecting cables.

IV. SPECIFICATION & DETAILS OF THE COMPONENT USED IN ROBOT STRUCTURE

Suction Cups

There are 4 suction cups are require.

Specifications

Property	Value
Design structure	Vacuum connection at top
Design structure	round, standard
Ambient temp	-20 - 60 °C
Operating medium	Atmospheric air
Shore hardness	62
suction cup diameter	50 mm
Mounting thread	G1/4
Vacuum connection	G1/4
suction cup mounting	G 1/4
Product Type	Festo Suction cup VAS VASB

Types of Power Supply

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable DC voltage supply for electronics circuits and other devices. A power supply can be broken down into a series of blocks, each of which performs a particular function.

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

DC motors have a rotating armature winding but non-rotating armature magnetic field and a static field winding or permanent magnet. Different connections of the field and armature winding provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives.

The introduction of DC motors to run machinery eliminated the need for local steam or internal combustion engines, and line shaft drive systems. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines.

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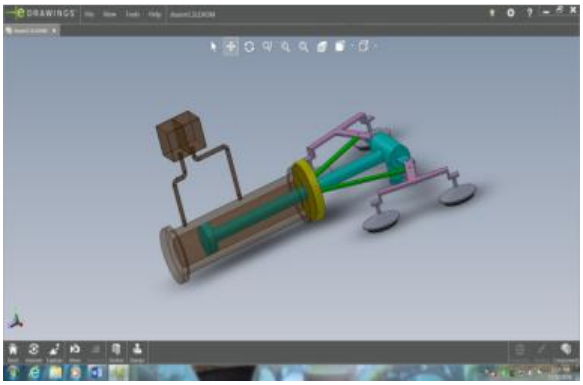
IV.3D DIAGRAM



V. CONCLUSION

This chapter presents an application of a climbing robot for the glass cleaning service. The robot is constructed by using two frames, Suction cups & Motor, Injection barrel.

Robot (WCR) having capability that it can stick on a vertical as well as inclined surface and can easily move over the surface. The targeted capability to stick with surface can be achieved by suction cups. Suction cups create a vacuum pressure used to stick with vertical or inclined surface. Future work will be toward developing more efficient motion control system and reducing size/weight of the climbing robot.

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