

DESIGN AND FABRICATION OF GLASS CLEANING ROBOT

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ABSTRACT- In universities and college glasses and windows have been clean by manual and human labour is involved and this process is risk of the human life. So, we have mentioned in this paper were designing a robot that cleans the glass automatically and reduce the risk of human life. Here we are using two pneumatic cylinder – Pneumatic cylinder are used for motion in X-Y direction, suction cup- Suction cup is used for support on glass. Micro controller - Micro controller is used to improve the movement of step, Bluetooth – Bluetooth is used for wireless motion of the robot.

Keywords: - glass cleaning, Pneumatic Cylinder, stepper Motor, Microcontroller, Motor Driver, Suction Cup ,

1. Introduction

Recently the automatically glass cleaning machine are used in cleaning the glass but there were many disadvantages in the previous project but our team has managed to overcome all the disadvantages of the glass cleaning robot. The overall cost of the previous were higher and cost high maintenance but our cost of maintenance is much lower than the previous project. Our main idea is that it to make a compact design, we have also used stainless steel so that the strength of the whole structure is very strong and overall age of the structure is high so we can conclude that the structure cost is one-time cost.

So we have concluded to that we have designed a model in which we have put a Bluetooth which is integrated with the mobile app which is installed in the smartphone/Smart device and by the help of the mobile or device we can easily control the motion of the glass cleaning robot. There are **Pneumatic cylinder** (2) and **suction cup** (4) which is fitted in the end of the **Trapezium Prism** of the all four edges of the robot. In **Threaded rod** (2) pneumatic cylinder are attached and movement will take place in X-Y direction. **Ardriano Micro controller** (1)

As the further process our team has gone through the survey-

- 1) It should be compact and less weight as the glass is a fragile object.
- 2) It can easily clean the corners of the window.

- 3) It can easily clean high-rise building.
- 4) There is Locomotion on the glass, so it will not create any mark on the glass panel.

2. Literature Review

Our Project is not from the scratch several previous works has been done on this topic. Some of the notified work done in this regard are given below.

As studying from the work of Requirement of Glass Climbing Robot **Houxiang Zhang** and **Jianwei Zhang** from university of Hamburg in 2004, so that have tried to operate by the pneumatic cylinder but our team concluded that overall cost of the project is much higher and they summarised and compared with three sky cleaner robot.

Tohru MIYANKE, Hidenori ISHIHARA, Ryu Shoji (2006) Paper Development of small size window cleaning robot by wall climbing mechanism. In this project he has used two independently driven wheels and active suction cup but the robot has errors in the attitude but we have overcome this issue.

Albagul, A- ASSENI, O. JOMAH, M. OMER, B. FARGE (2010) paper Design And fabrication Of Automotive robot. In this motion will generated by the three servo Motors in the time span of 2.5 Minutes.

Ritesh g. Mahajan 1, Prof. S.M Patil (2013) paper Development of wall climbing robot for cleaning application It clean the large glass

surface area with the wiper attach on the front of surface.

Vinod Kumar M.V, Prem Kumar Naik Prasad BG, Syedrazeequlla (2014) paper design and fabrication of automated glass curtain cleaning machine the cleaning drum is coupled to the wiper motor which rotates the

drum at 50 revolution. **Soichirokawasaki and Koki kikuchi (2014)** paper development of a small legged wall climbing robot with passive suction cups The project is based on single degree of freedom linkage leg based on the scale effect only. **Deepak Sachan, Avinash patil (2016)** Paper Design of electrostatic adhesion pads for wall climbing robot They developed the robot which can climb vertically with the help of electrostatic adhesion technology. **Nazim Mir-Nasiri, Hudyjaya Siswoyoj and Md. Hazrat Ali (2018)** paper Portable autonomas window cleaning robot the robot works on the pattern and sensory system was investigate to navigate the robot.

System design

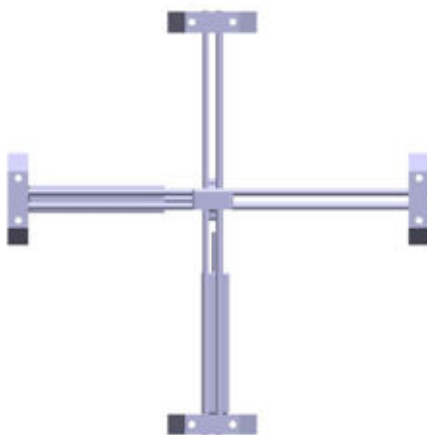


Fig 1

List of components

The major components used in

1. Pneumatic cylinder
2. Stainless plane rod
3. Arduino microcontroller
4. Bluetooth
5. Suction cup
6. Brush
7. Container
8. Battery
9. Android app

3. Methodology

3.1 CATIA DESIGN

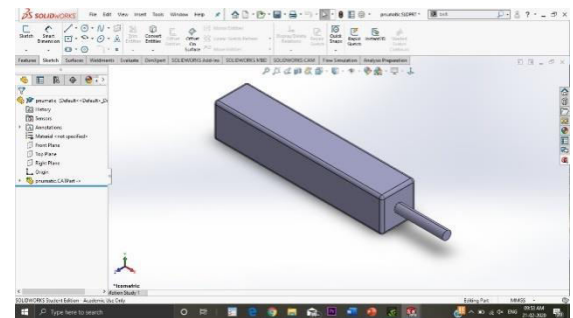


FIG.1 Pneumatic cylinder

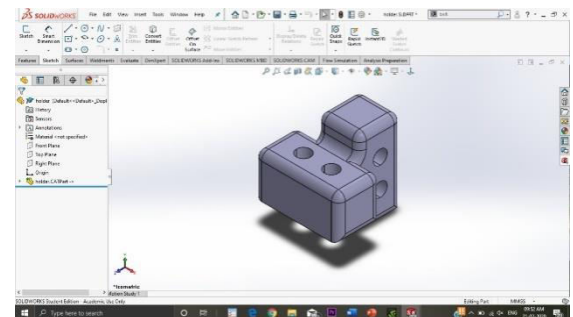


FIG.2 Base(for fixing cylinder rods)

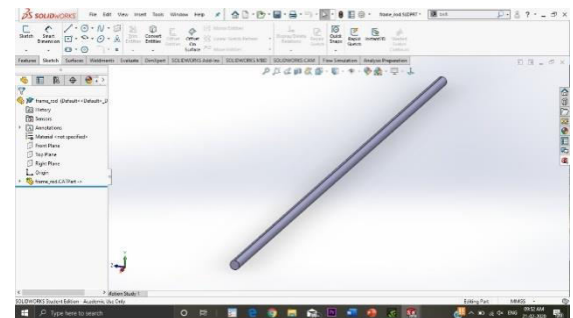


FIG.3 Cylinder Rod

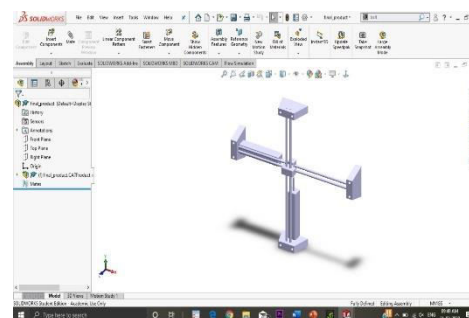


FIG.4 Approximate design

4. Working principle of Glass Cleaning Robot

It consists of two threaded rods attach at the ends of two rectangular bars at right angle, the pneumatic cylinder is fixed at each threaded rod at right angle. One is used for creating suction in horizontal member and another in vertical. When horizontal pneumatic cylinder is on horizontal member gets attach to glass via suction cup and hence vertical member is free to move in vertical direction similarly when vertical cylinder is ON vertical member gets attach and hence other member is free to move in horizontal direction.

For moving the member two motors are attached to threaded rods, one motor is attached to horizontal rod and other to vertical. The threaded rod moves inside a square bar having internal thread. When the motor rotates it rotate the threaded rod with it and hence the rod is forced by axial force because of threaded to move in axial direction. This process is done in both X and Y direction.

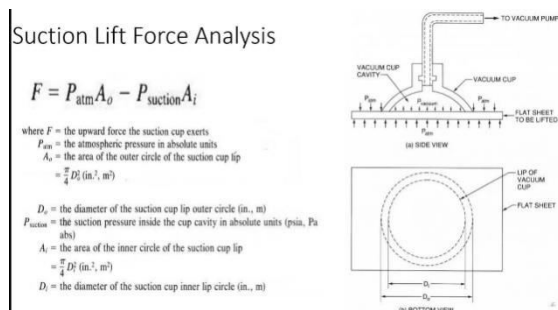
8 Suction cups are used for attaching the robot to the glasses, the robot has 4 Trapezoidal Pods, each pod Two suction Cups will be attaching hence at total 8 on 4 pods. All 8-suction cup are attaching to the pneumatic cylinder. The pneumatic cylinder creates suction for attaching the robot to the glass.

A small container of 200 ml size will be attaching at the centre of the robot which will spray water to the glass, a brush attach at the bottom of the robot will help in cleaning the glass. The container will be connected via pipe to the main water supply task at the top of building by this the weight of the robot is reduced to much greater extent.

For controlling the robot an Arduino based microcontroller is used, which can be controlled by phone via Bluetooth signal.

5. Mathematical Analysis

5.1 Suction Lift Force Analysis



5.2 Total time the robot will run, when fully charged.

Specifications of the battery- 12V 7Amp.

Battery output - 84W..... (1)

Power of the system = suction cup (12v

2amp) + ON/OFF Relay (5v 1amp) +

Water pump (12v 1amp) +DC motr (12v 1am)

= 53 W (2)

Power of Arduino and Bluetooth = 2.5W. (3)

Total power of the system = (2) + (3)

=53W+2.5W

=55.5W..... (4)

Total running time of the system when fully

Charged = (1) / (4)

= 84W/55.5W

= 1.51 hours.

6. Conclusion & Future Work

Our paper has described the application of glass cleaning robot. The glass cleaning robot is light wait and small size and it can be easily handled. The robot has suction cup that helps it to stick on the glass surface and it also helps in the smooth functioning of the robot. The above robot made by us was prototype. With some further modification we can also use it as a wall painting robot. Further work can be done on increasing the running time of the robot which would increase the efficiency. The water tank size could be increased so that more water can be supplied at the same time. More modern techniques can added from time to time to make it more efficient.

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