

## **DESIGN AND DEVELOPMENT OF UNIVERSAL WINDOW CLEANER**

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**Abstract**— *Pollution is nowadays a very critical these days. Due to pollution, the external glass walls of the building get dirty. To clean them with human support is very dangerous job. To eliminate this, fully automatic external glass wall cleaning machine design is proposed. The cleaning unit contains of wiper blade and water spray. This cleaning unit is guided with the help of hollow cylindrical shaft. It is controlled with the help of rope drive suspended from the top of the building which controls the linear motion. This whole unit is mounted on rails on the top of the building which helps in transverse motion. This whole unit will be controlled by a controller which makes the whole machine automatic.*

**Keywords**— *Window cleaning machine, rails, controller, automatic machine, wiper*

### **I. INTRODUCTION**

According to the latest results of the pollution in the modern time it is raising mainly to a great extent and also due to this there are several places where it is affected. One of the places where it is of great concern is the glasses of the window of the high rise building where due to the pollution the dust particles and smoke is collected on it and create a bad reputation of some reputed companies whose main offices and headquarters are there. Also, one of the main problem in current situation in India and other countries is that the labour is risking their lives by hanging itself through ropes to clean the external windows of these high-rise building which is a very risky and sometimes also due to some occurrence death of the worker takes place due to it. According to Occupation Safety & Health Administration (OSHA), 2.3 Million people work on cleaning glass wall. Out of them, 7500 people suffer injuries and 270 people suffer death. So, to overcome this pollution problem and also to eliminate the human risk of cleaning the window we are designing the efficient and affordable option to clean the windows automatically with just one click.

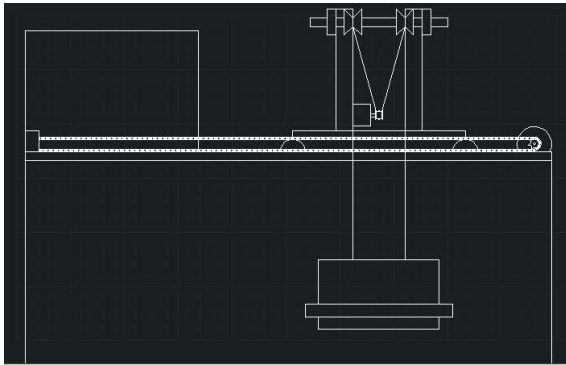
### **II. PROBLEM SPECIFICATION**

Universal window cleaner is the solution for the elimination of the worker's risk in India and also the major concern of the pollution which is creating a great affect on the window cleaning of the high-rise building. In the recent condition of India people are not aware about the safety of the worker only because they are cleaning their windows in a lesser money which is a very dreadful condition which can create some accident or may cause death of the worker. Universal window cleaner uses the modern technology in cleaning the windows by using simple wiper technique but with a use of a sprinkling water and effective solution which creates a clean and effective glass cleaning without leaving any dust particles or any dots which of great use for the offices and the headquarters of any MNC companies. Also in the 21<sup>st</sup> century the modern cities like Mumbai, Delhi, Chennai, Bangalore, etc., are also using the same old techniques for cleaning the external windows by giving contracts to the worker to clean. So, by creating proper awareness by giving the advantages of the modern cleaning system can stop the unwanted injuries and death of the worker.

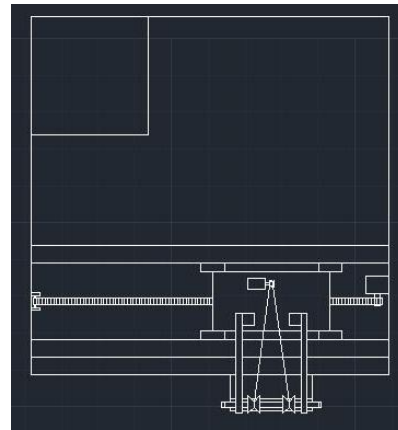


*Fig:-1 Suspended box for cleaning glass wall*

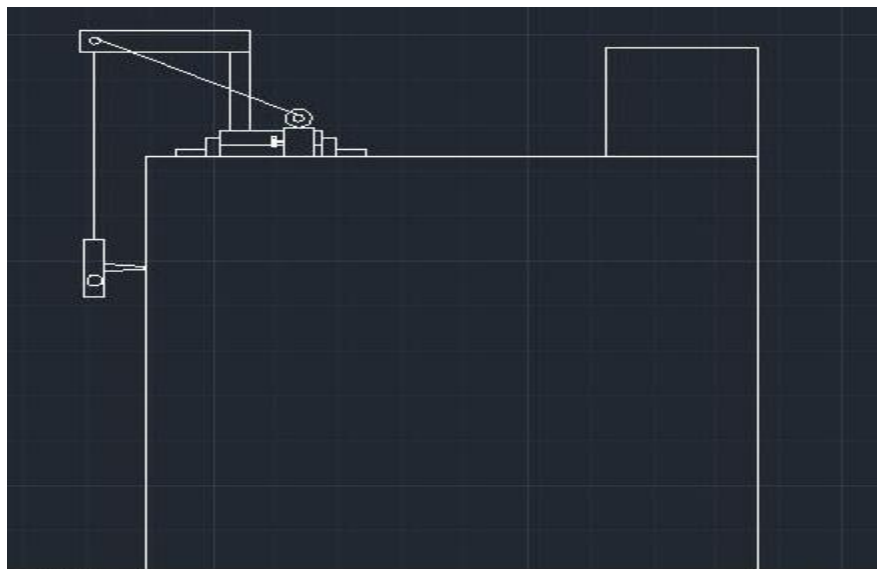
### III. DESIGN



*Fig-2.1 Front View*



*Fig-2.2 Top View*

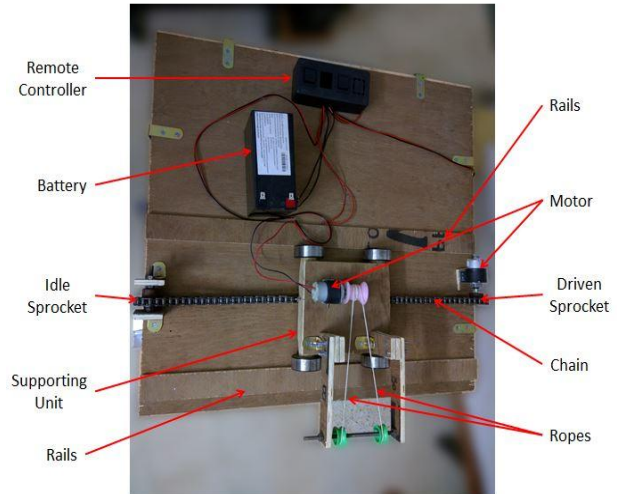


*Fig-2.3 Side View*

The figure shows the orthographic view of the building with each and every element that has to be used in our project. The mechanism used for horizontal motion of the cleaning unit is chain and sprocket which is connected to a motor with the hooks and the mechanism used for vertical motion is the ropes which are connected to the cleaning unit. The mechanism used for horizontal motion is chain and sprocket. One sprocket is connected to an electric motor which makes this sprocket the driving sprocket and one sprocket is idle & so it is known as driven sprocket. The chain is connected to the supporting unit with the help of hooks from both the sides. The motor used here is a two-way motor which helps the unit to move left as well as in right direction. The mechanism used for vertical movement is rope drive. Rope is collected on a pulley placed on the supporting unit. This pulley is connected to an electric motor. The rope is connected to the cleaning unit which is wound on the pulley on the other end as shown in figure-2.1. The motor used here is also a two-way motor which enables the cleaning unit to go up as well as down. The cleaning unit is the main unit which does the cleaning work. The cleaning unit consists of a pipe with two holes and a wiper. The wiper is placed above the pipe. The supporting unit consists of four wheels which will help the unit to move smoothly. The supporting unit is attached to a chain with the help of hooks which helps it to move in horizontal direction.



*Fig-3.1 Prototype of our project*



*Fig-3.2 Mechanism*

TABLE I  
 NAME OF THE PART, DIMENSION AND SPECIFICATION

Sr. No.	Name of the Part	Quantity & Dimension	Specifications
1.	Electric Motor	1	100 rpm
2.	Electric Motor	1	60 rpm
3.	Acrylic Sheet	3feet*2feet	2mm thickness
4.	Acrylic Sheet	8inch*6inch	5mm thickness
5.	Wiper	1	6 inch long
6.	Sprockets	2	25mm Diameter
7.	Chain	5feet long	--
8.	Bearings	4	25mm Inner Diameter
9.	Wooden Sheet	8feet*6feet	8mm thickness
10.	Metal Sheet	3.5feet*0.5feet	1mm
11.	Remote Controller	1	--
12.	Water Container	1	2 litre
13.	Pulley	1	--
14.	Idle Pulley	2	--

15.	Battery	1	12V
16.	Pipe	10-meter length	5mm diameter

#### IV. RESULTS AND DISCUSSION

Prototype evaluation was done and it shows a great result in the cleaning of the external window of the structure which looks alike of glass window made of the fiber sheet. The chain and sprocket mechanism also has a great strength to pull the mechanism of the wiper. When we first tested the prototype there were some errors and also the cleaning was not proper as only water was used. So instead of using only water we have also used foaming cleaner which cleans the dust particles and the dots effectively as per our analysis.

The time taken by the cleaning of the window was around 10seconds (1window size in prototype is 3ft\*4ft) which is quicker and accurate than the man-made cleaning. The design of the cleaner is also very ergonomic and user friendly. The main advantage of this cleaner is that it can be used in any shape of the building by using the rack and pinion mechanism at the end of the cleaner so that only mechanism will rotate on the guide ways with the help of the chain and sprocket mechanism. Also, the design for the wiper can be changed easily and can satisfy the need of any uneven glass surfaces. The main advantage of this cleaner is it is very cost effective and also it is handy and can be transported easily to the higher places with the few men needed in the installation process.

#### V. CONCLUSION

The universal window cleaner has been designed and used satisfactorily. We have used a simple wiper in place of any roller brush or any other tool which provides effective cleaning. Moreover, we can say that the cleaner makes effective cleaning and it is cost effective and user friendly. Also, some changes can be done to make it fully automatic with the help of PLC or Microprocessor by attaching limit switch at the end of the window which reduces the time used in this prototype. Using steel wires in the place of rope can bring very effective result in the cleaning mechanisms.

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