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DESIGN AND IMPLEMENTATION OF AUTOMATEDCLEANING OF CEILING FAN

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***Abstract*-The main objective of the project is to reduce the human effort and sluggishness of human when the operation is in large scale and to avoid the risk in case of any accidents. The proposed system that is portable and ensure regular cleaning of the ceiling fan using some mechanical setup such as scissor lift, lead screw whose movements are controlled by microcontroller which controls a pneumatic control and some cleaning mechanisms.**

Keywords-Automation, ceiling fan, lead screw, scissor lift, microcontroller, sensors, actuators.

I. INTRODUCTION

A ceiling fan, one of the most common appliances needs to be cleaned and this project is all about automating the cleaning system in a simpler and economical manner. This idea is something new and we are trying this to be exclusively useful in industries, schools, colleges, hospitals,etc where the number of ceiling fan count is quite large. Moreover, as the project proves to be a cost effective one, it can be used in households as well. There is no current system that is being tried for the automation for cleaning ceiling fan. The current system involves the hand operated stick with a brush to clean off the dust spread over the fan. So we tried to eliminate this simpler human effort in an effective manner. In schools or hospitals, where the number of fan population is large it is quite difficult to clean the fan by human regularly, and people also leave it in ease without considering that the dust is interpreting that it may not harm them. Of course, it does harm them, especially in government hospitals where patients are the victims. Also by automating the system, the laziness of human could be overcome and the cleaning of the fan is done regularly. At the outsight, the idea may seem to be a simpler one but this project involves various mechanisms and circuits. The lead screw arrangements at the base and over the wooden base, scissor lift and a microcontroller that is used to control the 3 motors simultaneously are the various primary components used in the system.

II. OBJECTIVE

The prime objective of the project is to completely automate the ceiling fan cleaning mechanism with a portable system for this simpler task. The portability of our project is the major advantage which ensures that the system can be used in large scale. Another aspect that goeshandinhand with portability is the weight reduction of the system, which in turn makes the system a portable one. The portability and weight reduction ensure ease of use of the system. As the system should reach the roof of the room, the system obviously cannot be of low weight. Hence, the system is designed with the lowest possible weight. The scissor lift used in the system is made of aluminum [8] primarily for the weight reduction and increasing the portability [2].

III. PROBLEM DEFINITION

A. *Existing System*

The existing system does not involve any kind of automation in cleaning the fan. It involves complete human effort that may certainly turn risky in case of a very high roof and in case of a many numbers of fans the human often tends to sluggishness effect and loses interest over a period of time.

The current system can be characterized by

- Human effort on the whole
- Sluggishness of human in large scale units
- Risk in case of any unfortunate accident

B. *Proposed Solution*

The automation of cleaning system of ceiling fan using scissor lift mechanism actuated by lead screw arrangement and controlled by anAtmega 16A microcontroller [6].

C. *Advantages*

- Easily implementable
- Ensures regular cleaning of fan
- reduces the human effort in case of large
- Scale units

IV. FEASIBILITY STUDY

A. *Economic Feasibility*

Implementing our solution is more possible in an economic way. The scissor lift mechanism which forms the major part of the system is made up of aluminum which is not expensive. microcontrollers and motor driver circuits are readily available in the market at a cheaper rate. DC motors are used for actuation and hence the project proves the total

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amount sums up to around Rs.5000 and hence it can be invested to bring a fruitful result. Hence the project is economically feasible and it can be followed by design and fabrication process.

B. Operational Feasibility

The operation of the entire model can be achieved by operation of three different sections namely the base motor section, sensing section and cleaning section. The base motor section aims to lift the scissor ladder to reach the height of fan. This could be achieved by converting motor's rotary motion into reciprocatory motion using a lead screw arrangement and hence it is operationally feasible. Also, the DC supply to the motor is fed using a step down transformer and a rectifier circuit. In the sensing section, the proximity sensor enables the sensing of the fan blade, and simultaneously the electromagnet holds the cup (center part) of the fan. The cleaning section is actuated by DC motor and lead screw arrangement placed over the wooden base. The microcontroller controls the process of cleaning in a sequence [1].

C. Technical Feasibility

Technical success of the project relies upon the work expected from the different section of the project. The base motor and lead screw arrangement must ensure that the scissor lift is raised and it reaches the fan. When the scissor lift action becomes successful, the sensing section which consists of proximity sensor must sense the blade. Control section can be implemented with help of micro controllers and programming of micro controller for the cleaning process. Many software platforms are available to program the controllers. DC motor can drive the scissor lift and it is technically possible by coupling it with lead screw arrangement. They can be coupled using welding. The cleaning is achieved using a vacuumcleaner system. Hence, technically also the project can be implemented.

V. DESIGN SPECIFICATIONS

A. Components

The various components in the model are shown in the table 1

TABLE 1: Components involved in the model

S.no	Components	Description
1	DC Motor	12V, 20 kgf-cm,45 rpm,12V 5 kgf-cm, 60rpm
2	Micro controller	ATMEGA16A
3	IC 7805	Voltage regulation to +5 V
4	L293D	Motor driver
5	Capacitors	100uF,1000uF
6	Resistors	220Ω,1kΩ,10kΩ
7	LED	Red, Green, Yellow
8	Scissor lift	Aluminum blades
9	Lead Screwarrangement	Mild steel rod
10	Electromagnet	AC wire wound type
11	Transformer	220v to 12v 4amp

B. Design Calculation

1) Calculation Of Scissor Lift:

The fig 1 shows the scissor lift [7].

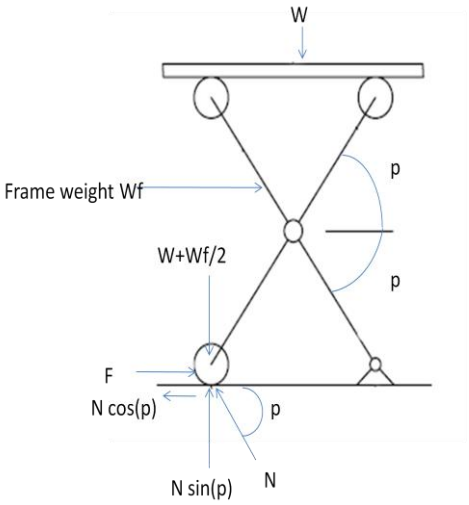

Fig.1. Reaction forces acting on Scissor lift

The various forces and reactions acting in the structure of scissor lift can be described as

$F = N \cos(p)$ (1)

$N \sin(p) = w + wf/2$ (2)

$N = (w + wf/2 \sin p)$ (3)

$F = (w + wf) \cos(p)/2 \sin(p)$ (4)

$F = w + wf/2 \tan(p)$ (5)

For $\Phi = 45$, $F = 5.255$ N

For $\Phi = 70$, $F = 1.92$N

VI. FABRICATION PROCESS

A. Electrical Section

This segment includes the creation of PCB and rectifier circuit. The initial step of PCB configuration is the creation of the primary circuit of microcontroller and engine driver and the hand-off circuit by programming recreation utilizing Proteus proficient programming the second step of PCB

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configuration is the execution of the circuit created in Proteus proficient programming in the PCB. This is accomplished by a progression of procedures. The impression of circuit is exchanged to the copper board by methods for iron box. The copper layer in the PCB is expelled by scratching with ferric chloride arrangement. The copper board is bored utilizing a hand bore and the segments are settled and fastened.AC voltage to DC voltage is changed over by a rectifier circuit. The Air conditioner voltage is ventured down utilizing a stage down transformer and it is nourished to the rectifier. The rectifier, along these lines, changes over 230V Air conditioning into 12V DC which is given as contribution to DC engine. The PCB utilized as a part of the venture interfaced with LCD. The figdemonstrates the PCB module.

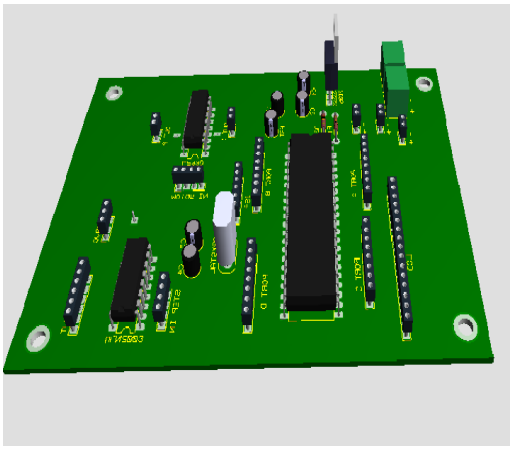

Fig.2. PCB module

B. Mechanical Section

The primary component of the mechanical section is the scissor lift design. It is made of aluminum plates. The aluminum plates are drilled with a hole of 1 cm at the center and the corners for assembly with the next plate as shown in the figure. The scissor lift assembly is welded by arc welding to the base and interfaced with the lead screw arrangement. The lead screw is coupled to the dc motor [4].The wooden base, which holds the electromagnet and the second lead screw, is mounted over the scissor lift. This completes the fabrication of the mechanical section. The view of the whole project is shown in figure3.

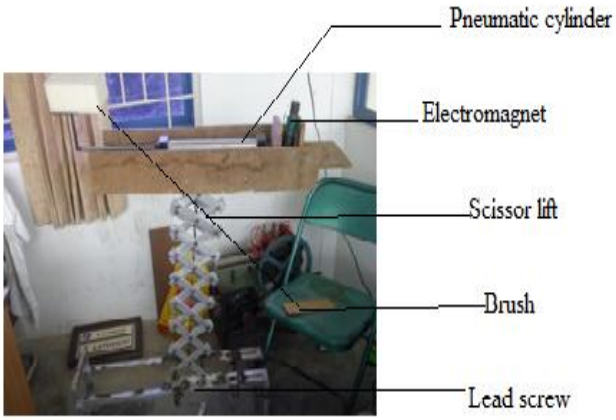

Fig.3. Mechanical section

C. System Description

The project involves the methodology of cleaning the fan blades individually one after the other. Microcontroller forms the heart of the system and carries out the sequence of operation as per the programming. The system involves a total of 3 motors and the system is completely electrically actuated. The system carries a scissor lift that forms the mounting of the actuating system to the close proximity of the fan from ground. The scissor that consists of linkages is electrically operated so that the linkages in which the linkage that consists of one fixed ends and free end is lifted upwards. This electrical actuation is assisted by the action of ac synchronous motor and a lead screw mechanism to lift the ladder. As the scissor lift gets in close proximity with the fan, the centre of the fan, described as the switch cup, is sensedby the proximity sensor placed in the base made of wood where the actuation system with other components is being placed. The electromagnet, includedin the list of various components in the base that is coupled to a motor is attracted towards the switch cup and comes in contact with the switch cup. The purpose of an electromagnet is to rotate the fan every time after one of the blades is cleaned. So, as the scissor lift reaches the proximity of fan, the other proximity sensor being placed at the other side of base senses for the blade and asthe blade reaches the required position, it is programmed such a way that the pneumatic cylinder actuates the cleaning brush to clean the fan blade. There were several methods applicable for the cleaning mechanism of the blade. Some of them are: vacuum cleaner system that is being mounted on the place of the brush, usage of sponge system coupled with the robotic arm but for an economical as well as effective setup we have chosen the sponge setup for the cleaning process. The fig 4 shows the 3D model of the project.

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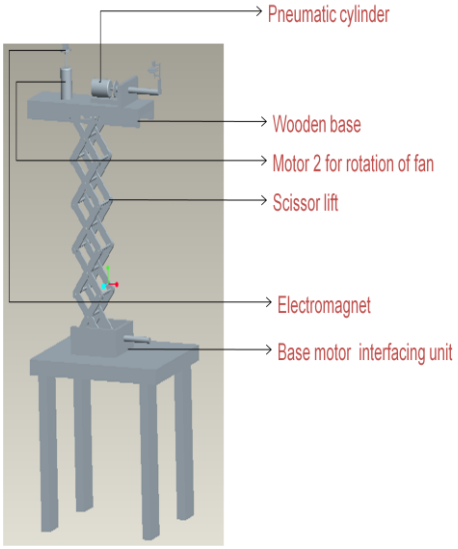

Fig..4. Pro-E-Model

VII. CONCLUSION

In this manner another framework for cleaning of the roof fan is produced. The total mechanization of the framework is accomplished and the framework turns out to be practical also. Likewise, the goal of our framework, convey ability is happy with the plan that has been created. This ensures the regular cleaning of the fan in various localities such as hospitals, schools, and industries etc. Also, the regular cleaning of fan can be ensured using the automated system. Thus, the hygienic environment is promoted and the health of the person who needs to clean the fan will not feel sluggish. The dust sufferers are the main benefits of this system and in case of houses with small children and babies, this system proves to have a great advantage.

VIII. FUTURE SCOPE

Currently implemented idea involves microcontroller for control and automation of the system. Use of fuzzy logic system for control can be implemented in future which is more beneficial [3]. Usage of vacuum cleaner setup could be promoted in the system so that the dust doesn't get accumulated in the environment. Usage of scissor lift mechanism can be eliminated by the utilization of telescopic cylinder mechanism, which is recently developing technology prevailing in the automation world; however has some disadvantages [5]. Also, the present system involves a pneumatically operated brush system. This system can be replaced by electrical actuation so that we don't need a compressor. To clean the blades in a more effective way, the brush system could be replaced by a solenoid actuator system which holds the blades and cleans it.

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