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''Design and Development of Prototype for Floor Cleaning of Car''

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Abstract: *Design and development of car does not just include design and manufacturing of mechanical parts like engine, transmission , chassis , but also non technical aspects are important such as comfort, Ambient (Atmosphere) , ease of control , cleanliness ,Ergonomics and Aesthetics. Humans spend too much time in the car and if there are any dust and dirt particles it makes the environment unpleasant causing distress. And to keep the car clean is essential for a long time*

The project includes prototype for Automatic floor cleaning of car. The system routinely cleans the floor are of the car before an after use or on passengers demand. It consists of a mechanism using XY plotters, servo motors ,vacuum pump, servo motor shield for controlling the prototype. Market survey was done for studying various methods used by the car detailing shops in India. The current methods costs a lot more for a period of 5 years. A prototype was developed to reduce the cost required as well as the human effort needed

Keywords: *Stepper motors, Rubber bush, Arduino UNO ,Stepper motor Shield , GT2 belt, M10 threaded rods, 12v battery*

I. Introduction

In this 21st century car has become an essential part of the human life. In day to day life car plays a significant role for driving the human life ahead. Most of the people around us are having cars and the compelling problem most of the car users face is the interior dirt cleaning. So the XY mechanism with the help of vacuum pump is used for the interior cleaning which will suck the dirt in the car moving in XY direction on the floor of the interior. The system will not take much space and is also convenient at the same time which makes it easier to use. In recent years, floor cleaning automation have taken major attention in research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels ,restaurants, offices, hospitals, workshops etc. This is solemnly aimed to replace the men at work to "no man at work." Basically, conventional cleaner are distinguished on their cleaning expertise like floor mapping, dry vacuum cleaning etc. Each cleaning and operating mechanism of floor cleaners has its own advantages and disadvantages. The conventional vacuum cleaner system consists of large mechanical and electrical parts which are more costly and incur more losses. It works only on AC which consumes more power around 1000W and we cannot use it during power outage period The mechanism consists of a microcontroller system controlled by Arduino board, and G code and stepper. The end of the XY mechanism will have a nozzle. Nozzle will maintain certain distance from the floor. The mechanism will follow pre-programmed path and collect all debris using G-Code. It is a function to tell the machine to move to various points at the desired speed. In this mechanism G-Code is employed by the part programmer. For the core system Arduino system is most familiar by the inventor and mainly used in most of the electronic components because of compatibility of the system with the hardware. Meanwhile, low cost and easily controlled function of Arduino system contributed on simplifying the building circuit of the microcontroller in the mechanism.

The X-Y Mechanism consists of low power consuming electronic and mechanical parts and it can operate during power outage period and does not need any human guidance. XY Mechanism have electronic components which power and control the machinery, That power comes in the form of electricity, which will originate from a car battery, a basic electronic circuit plays a vital role here. The electronic aspect of mechanism is used for movement through motors. Arduino UNO is an open-source physical computing platform a simple input/output board and a development environment that implements the Processing/Wiring language. The board based on ATmega2560 microcontroller. it contains 54 input/output pins, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button (Arduino). Thus, it is needed for the project to control the movement of the 3D printer axis and the extruder through stepper motors. To power the system a 12V 10A power supply is used since the recommended input voltage is between 7-12V. The board may be unstable with low input voltage and could be damaged with high input (Arduino). Therefore, using the precise power supply and accurate connections are required to guarantee preferable outcomes .Vacuum cleaning system

used in this X-Y Mechanism is Cyclonic type filtration system which works under the principle of forced vortex flow same as in case of centrifugal pump. Centrifugal force will be created and all types of debris will be sucked in through pipe. The advantage of using this X-Y Mechanism will saves time, it will be very much useful for people with mobility issues to clean the house without any difficulties. It is a simple and low cost X -Y Mechanism. The main objective of this project is to provide substantial solution to the problem of manufacturing X –Y Mechanism utilizing local resources while keeping it low costs. Here represents the technology that proposed the working of mechanism for Floor cleaning. there are several models for X-Y Mechanism, this Prototype is designed in economical way. Main advantage of this Prototype is replacing the tool based on any application such as cleaning, foam spreading and soaking of foam painting any surface

1.1 Problem statement Most of these dirt problems are due to mould, constant use of car which is essential for most of the people and last but not the least problems related due to rainy seasons and the sand entering the car, this complication occurs mostly in desert areas. The dirt and mould also causes an unpleasant odour in the car which is unhygienic for health. This dirt can cause many health related problems. If this dirt hangs on for little bit longer it start to deteriorate the interior of the car i.e underfoot carpet.

1.2 Objective The objective of the project is to design and develop a prototype for floor cleaning of car. To reduce expenditure of cleaning process. To develop vacuum pump initially for dust and particles upto small extent. Analysis of suction pressure of vacuum pump

II. Market Survey

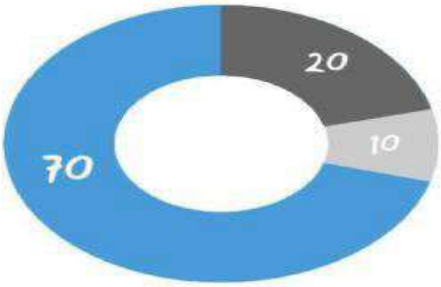

Fig.1 Percentage of different processes

It is observed that normally 70% of the car spas and washing centers use a common method of cleaning the carpets. Spa owners basically clean the carpet by taking out them and dry vacuuming it.The other method is used by 20% of the car spas and washing centers. Spa owners generally repeat the first method succeeding with adding carpet cleaner solution and thoroughly brushing it. And finally wiping out the surface with micro fibre material towels.

The last method was roughly used by 10% of the car spas and washing centers. Spa owners basically use a wet vacuum cleaner for cleaning the carpet which fundamentally sucks out the dirt within Most of the washing centers in the united states of America use steam for the floor cleaning process. Car carpets steaming:- Steam cleaners removes dirt and odors from the carpet and the bristles will lift the fibers of the carpet to rejuvenate the overall look of the carpet. The carpet only takes a few minutes to dry after cleaning. Vacuum afterwards for perfect lines.

Steam cleaning to remove salt stains:-Dup ray steam cleaners easily dissolve salt tracked into the car from winter roads .Remove the salt rocks using the steam cleaner and a car detailing brush, then wipe with a microfiber cloth for instant dissolution of the residue. Steam vacuuming carpets and mats:-The Carmen Super Inox is the best commercial steam cleaner with wet and dry extr action capability. Offered either on 110V or 220V power, it is the most powerful commercial grde steam extractor available. This versatile steam cleaner performs the same functions as a carpet extractor but also cleans hard surfaces. It comes packed with various cardet ailing attachments, and there is an optional upholstery metal tool available for purchase. The Carmen Super Inox can injects detergent into the steam and onto the carpet. The significant extraction power of the unit (2200mm of water column lift) results in the complete removal of all odors, dirt and stains. Most carpets dry in just minutes.

III. Design and Development

3.1 X-Y mechanism-

X-Y mechanism a such that provides the horizontal motion to the automated machinery such like 3-D printer, robot assembly etc. The table has the limited range of motion. It allows the motion along X and Y axis and the base remains same.

3.2 Working of mechanism:-

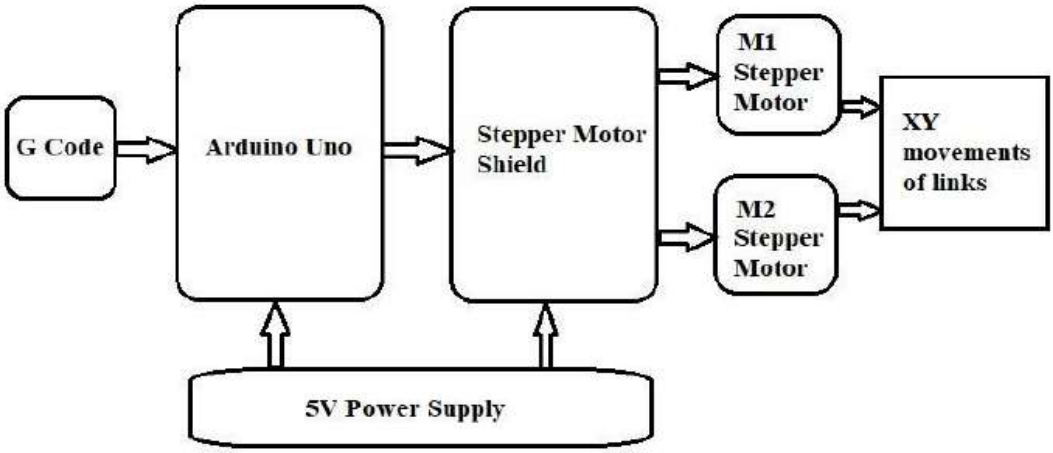

Fig.2 Flowchart of prototype

XY mechanism contains the two drive motors i.e. stepper motor with pulleys. The prototype consist of 4 links for one horizontal motion and other 4 links for other vertical motion. There are five idlers out of which four idlers are at the centre of platform. The other one idler is placed apart from platform at right angle with the stepper motors. A open belt is wrapped to the idlers and pulleys. The motion of two stepper motors can the travelling of platform in horizontal plane. The sense of rotation define the axis of motion. The stepper motor are operated through the aurdino and powered by lithium-polymer batteries. The suction will be through vacuum pumps provided at the end of the X-Y mechanism.

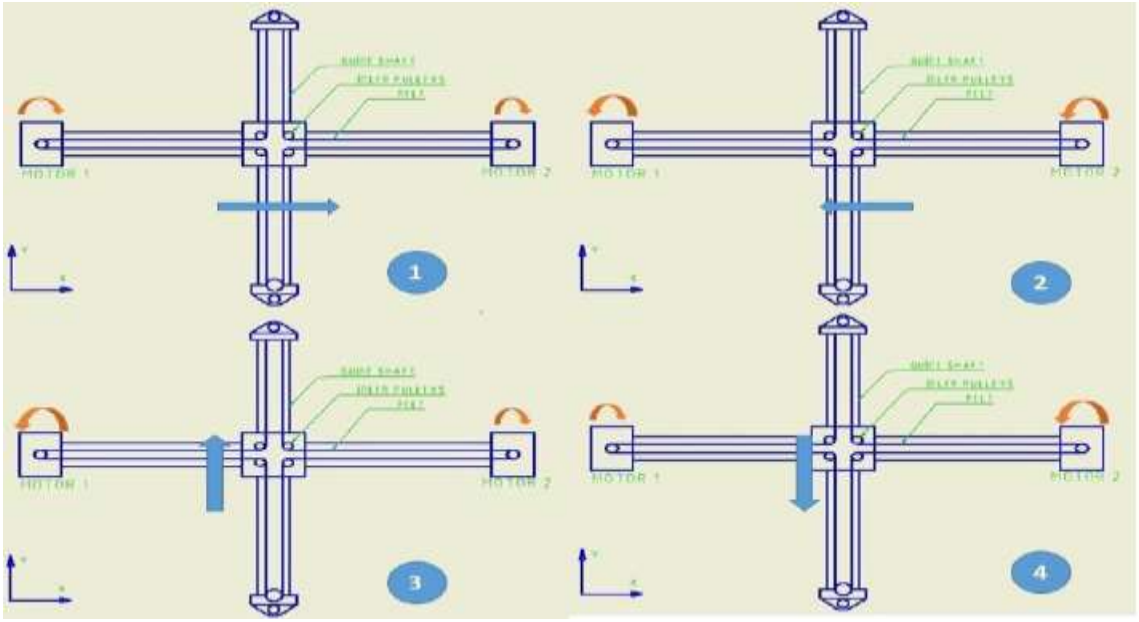

Fig.3 Direction of motion of X-Y links

- When Motor 1 moves in backward direction and Motor 2 in forward direction the Y-link moves to position 2
- When Motor 1 moves in forward direction and Motor 2 in backward direction the Y-link moves to position 1

- When Motor 1 moves in forward direction and Motor 2 in forward direction the X-link moves to position 2.
- When Motor 1 moves in backward direction and Motor 2 in backward direction the X-link moves to position 1

3.3 Bill of material:-

Sr. No	Materials	Quantity
1	Stepper motors- 48 steps, 4kg-cm	2
2	8 mm smooth rods(500mm-long)	4
3	Rubber bush	8
4	20-tooth GT2 pulleys	7
5	Arduino UNO	1
6	Stepper motor shield	1
7	GT2 belt(1.4 meters long)	1
8	M10 threaded rods(500mm long)	2
9	M10 nuts	12
10	M10 bolts	4
11	12V 2A power supply	1
12	Foam 10 mm thickness	1

Fig.4 Bill of material

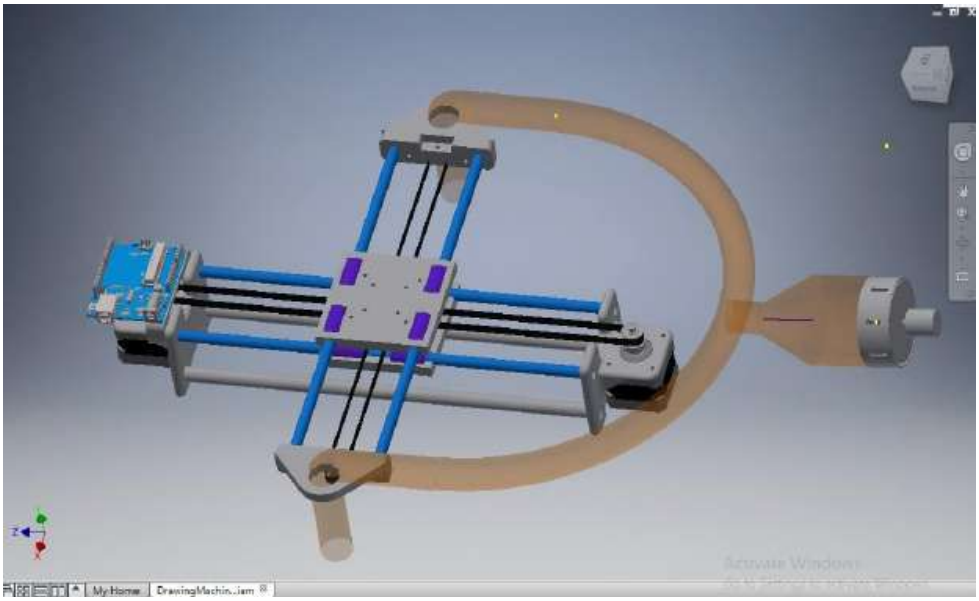

Fig.5 Prototype assembly

IV. Future Scope

Various parts of the interior of the car can be cleaned using the mechanism which includes roof. Dashboard. Seat which makes interior cleaning of the car very convenient and less costly than the current methods. This also helps in saving time at the same time. Wet vacuum can be attached to the end of the mechanism if there are stains on the seat cover due to coffee etc. This model is a conceptual model and further passed through various development phases for actually launching in market to make the model more economical and also feasible at the same time. The system can be made more intelligent with the help of camera and sensor. The camera and sensor scans the dust on floor and the mechanism follows the route and with the help of vacuum pump sucks it in .The mechanism can be controlled with the help of mobile app which is the most convenient way to on/off .The Prototype will lead to reduction in manpower along with to increase work efficiency.

V. Conclusion

Large day to day variations make it nearly impossible to maintain constant cleaning of car with only human efforts. The prototype designed for floor cleaning of the car able to perform routine cleanup is designed and it is able to perform routine cleanup as per user's instruction. The objectives which were set at the start of project like,

1. Reducing expenditure of cleaning process,
2. To develop vacuum pump up to small extent.
3. Analysis of suction pressure of vacuum pump

All the objectives were achieved and the suction pressure is up to the mark of taking in dust and dirt particles .With increase in demand for automation and quality use of technology is gain ingimmense popularity in the manufacturing industry. This project is a step towards affordable automation which can be implemented in various cars. Further optimization of this design can make this project viable even more

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