



Design and Development of Automatic Car Cover

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Abstract: In the early 20th century car has become widely available, most of the time cars are parked in garage or in a shady place to protect the car from sun radiation and rain or car cover can be used. The car cover has a rough shape of car which is made by certain materials. These materials are selected according to the use of application. Covering the car with car cover is done with man effort and this job is a tricky one. In our project we are going to present an automatic car cover mechanism which will open and close itself with the help of the push button. It covers the whole car with a thin, but strong material that not only protects the car from rain, dust and mud (in parking situations) but also from minor scratches. If there is a car cover that deploys automatically, it will protect luxury cars even in the worst situation. It is purpose of the current application to provide a car cover that comes out of a car's trunk, deploys, and restored into the trunk automatically by a simple press of a key.

The project aimed at developing Automatic Car Cover System incorporates a user-friendly mobile application, enabling owners to remotely control and monitor the status of the cover. The application provides real time notifications, allowing users to stay informed about their vehicle's protection status. The system is designed with durability and adaptability in mind, accommodating various car sizes and shapes. By minimizing the impact of external elements on vehicles, this work aims to extend the lifespan of automobiles and reduce maintenance costs. The Automatic Car Cover System represents a step forward in automating everyday tasks, promoting convenience and preserving the aesthetic and functional aspects of our valued automobiles.

Index Terms - Car Cover, Car Umbrella, Folding mechanism.

I. INTRODUCTION

For almost a century, cars have been utilized for transportation. Cars are mostly utilized to transport people rather than products due to limited space and the number of passengers seated. Today's technology has advanced, and every aspect of an automobile has been designed with the user's comfort in mind. Cars were increasingly accessible in the early twentieth century, replacing animal drawn carriages and carts. Cars are often kept in a garage or in a shaded location to protect them from UV rays and rain, but a vehicle cover can be utilized. Automobile covers have a rough outline of a car and are constructed of various materials. These materials are chosen based on their intended function.

Covering the car with a car cover requires manual work and is a difficult task. We must first identify the front and back of the cover. Then, first, wrap the cover around the front bumper, then drag it over the top of the car, and last, wrap it around the back bumper. A car shelter is a huge sheet of protective fabric material in the shape of a car. When a vehicle is not utilized for an extended period of time, a car shelter is used to protect it. Car shelters can protect your parked car from the harmful effects of acid rain, UV radiation, bird droppings, sun fading, windborne particles, animal claws, and even the prying eyes of criminals.

Saad Bin Abul Kashem, Aws Dhafir Yasin & Elam Maran Jayamani (2017) Constructed automatic device on vehicle to prevent heat penetration inside the car body. Their device is fully autonomous to cover the car when parked in outside parking. Their system will prevent any vehicle from getting affected by heat produced by the solar energy. SolidWorks design and simulation has been done to analyze the required power by the system. Finally, a prototype has been built and the feasibility has been checked.

Suh Ted Justin (2009), Invention provided on automatic car cover system, driven by electric motors, for a car, which is equipped with an automatic opening/closing trunk lid is provided. It includes one cover runner, one holster, one holster casing, one guide, onceover sheet, and one cover sheet un-folder. Cover runner is a small electric motor driven vehicle equipped with caterpillars, which are comprised of magnetic plates covered with rubber. The holster comes out of and goes into trunk of the car with aid of a line connected to a reverse power motor installed in the holster.

Xuhua Wu (2010), Invention provided on a built-in type car cover. The downside of the car is internally provided with a built-in automatic cover-winding device. The middle of the built-in automatic cover-winding device is provided with transverse scroll bar, the car cover is wound on the scroll bar, and the scroll bar is connected to an operation station in the car by setting leads in an electrically winding way. When the car runs, the built-in car cover is wound inside the downside of the car trunk, when the car needs to be covered during the parking, the cover can be drawn out and pulled forward from the back to cover the whole car body, and the winding and loosing of the scroll bar are operated by an electric button on an instrument panel in the car.

A good cover within the garage provides a barrier against foot-borne varminths and airborne filth. This paper will demonstrate an automatic car cover mechanism that will open and close itself using a push button. It covers the entire automobile with a thin but durable covering that not only protects the car from rain, dust, and dirt (while parked), but also small scratches. If a car cover deploys

automatically, it will safeguard the expensive vehicles even in the worst-case scenario. The present application's goal is to offer a car cover that automatically comes out of a car's trunk, deploys, and returns to the trunk with the touch of a key.

II. DESIGN CALCULATIONS

Wind Load Calculation

The wind pressure can be approximated by:

Pressure = $1/2 \times (\text{density of air}) \times (\text{wind speed})^2$

Density of air = 1.2 kg/m^3 (Density of air at sea level)

Wind Speed = $16.67 \text{ m/s} = 60 \text{ kmph}$ (This value is taken from Beaufort scale given case 7)

The wind is so strong at this speed and it will impede the movement of the umbrella user. It is not safe to stay outdoor at anymore and any umbrella will not help in those situations.

Pressure $P = 1/2 \times (\text{density of air}) \times (\text{wind speed})^2 = 1/2 \times 1.2 \times 16.67^2 = 166.73 \text{ Pa}$

Wind load acting on umbrella $F = C_d \times A_e \times P$ Where,

$C_d = \text{Drag coefficient} = 1.17$

$A_e = \text{Effective area} = 2.5 \times 1.8 \text{ m}^2 = 4.5 \text{ m}^2$ (Wheel base and wheel track of MG Comet is taken into consideration)

$P = \text{wind pressure} = 166.73 \text{ Pa}$

Wind load acting on umbrella $F = 901 \text{ N}$

Calculations of Dimensions of Link

Consider main 8 links of conceptual model majorly take the load. Total wind load

$F = 2.12 \text{ KN}$ Load on single link = 112.625 N

Design the link for bending Length of link = 500 mm Load on single link = 112.625 N

Consider the load of 112.625 N is uniformly distributed over the length of 500 mm .

Therefore, $\text{UDL} = 0.22525 \text{ N/mm}$

Considering Material of Link is Aluminum 6061

Table 2.1 Properties of Al6061

Property	Value
Density	2.7 g/cm^3
Young's modulus	70 GPa
Yield stress	240 MPa
Tensile Strength	260 MPa

Considering Material of Link is Structural Steel

Table 2.2 Properties of Structural Steel

Property	Value
Density	7.85 g/cm^3
Young's modulus	200 GPa
Yield stress	152 MPa
Tensile Strength	260 MPa

Dimensions of Link

Considering, factor of safety =2

Allowable stress (Al6061) = 240/2 = 120 N/mm²

Allowable stress (Steel) =152 = 76 N/mm²

$$\sigma_{all} = M \times y / I \dots\dots\dots eq.1$$

If square section is considered, I =14 /12 and y =1/2, putting these values in eq.1 we get value of L= length of side of square section =7.06 mm

Design of Connecting Pins of Link Design of connecting pins of link

Table 2.3 Dimensions of Connecting Pin

Property	Value
Load acting on single link	112.625N
Length of link	500mm
Location of pins on link	at 0 mm, 250mm & 500mm
Diameter of pin, d	7.55mm

Hence bolt of M8 is safe for umbrella.

Selection of Linear Actuator

Stroke of linear actuator required to full open the car umbrella=250mm

Load which linear actuator has to lift =Wind load + Weight of umbrella

$$=2120+5 \times 10$$

$$=2170 \text{ N}$$

Referring catalogue of Hiwin, Model –HiwinLAM2-1 is used

III. DRAWING AND MODELLING OF COVER MECHANISM

Based on the above calculation several mechanisms have been selected on trial and error basis and finally the umbrella mechanism with side rollers was found to be successful for the present work. The detailed mechanism and its dimensions are presented below.

2-D Diagram of Automatic Car Cover with components of link

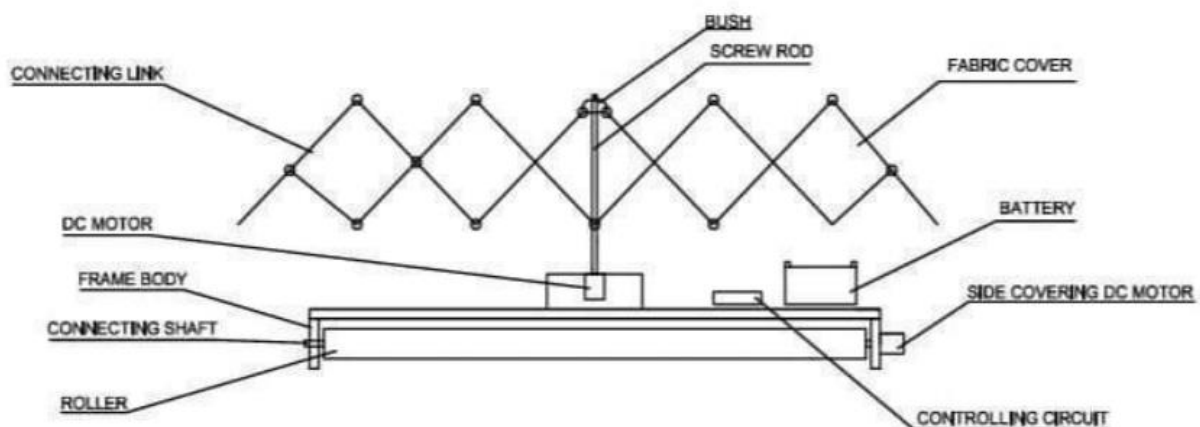


Fig 3.1 Detailed components of umbrella mechanism of Automatic Car Cover

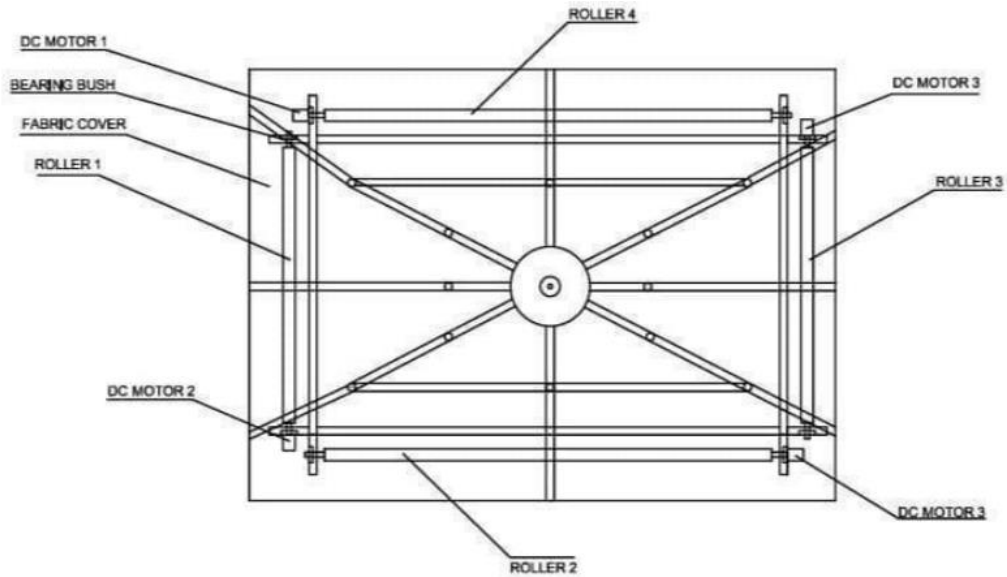


Fig 3.2 Top view of Umbrella mechanism of Automatic Car Cover

2-D Diagram of Automatic Car Cover with Dimensions

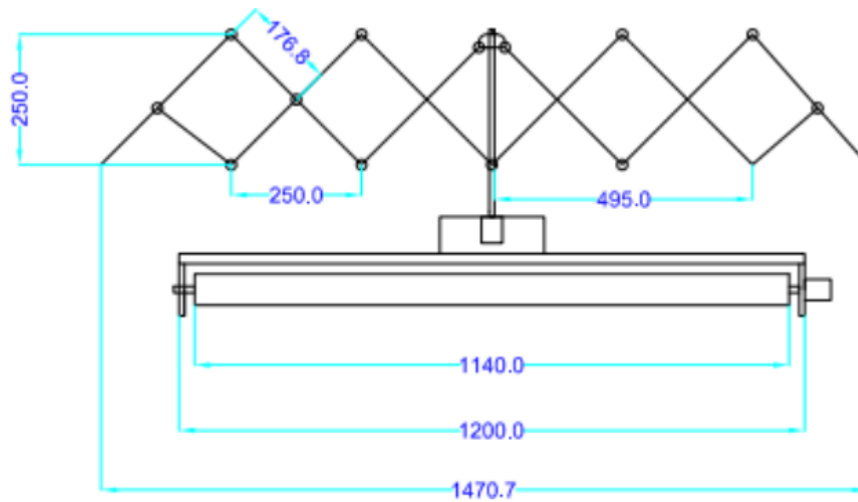


Fig 3.3 Detailed components dimensions of umbrella mechanism of Automatic Car Cover in front view

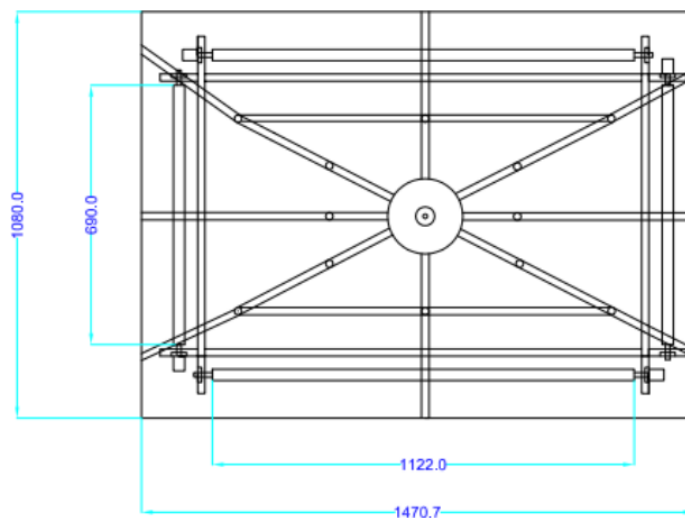


Fig 3.4 Detailed components dimensions of umbrella mechanism of Automatic Car Cover in top view

3-D Modelling of Automatic Car Cover Views

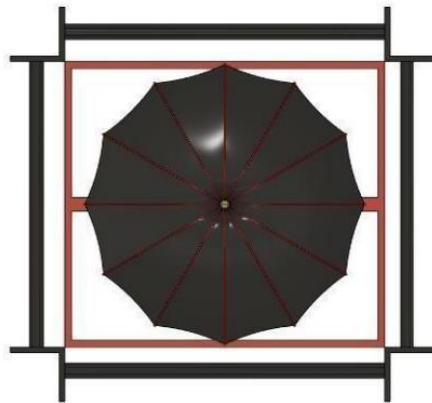


Fig 3.5 Top View of Automatic Car Cover with umbrella



Fig 3.6 Isometric View of Automatic Car Cover with umbrella in open position

IV. FABRICATION

Mild steel is a type of carbon steel with a low carbon content, making it relatively soft and easy to work with. It's commonly used in construction for structures like beams, frames, and columns due to its strength and affordability. Mild steel can be easily welded and formed into various shapes, making it versatile for different applications. Its corrosion resistance is moderate, often requiring additional coatings or treatments for long-term protection in harsh environments.

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled either over a wide range, using a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

Fabric can be made from various materials, including cotton, polyester, silk, wool, and more. Each material has unique characteristics, affecting the fabric's texture, durability, and care requirements. Switches can support link aggregation, combining multiple physical links into a single logical link to increase bandwidth and provide redundancy. A switch is used in computer networking to connect multiple devices within a local area network (LAN) and facilitate communication between them. UMBRELLA Umbrellas are portable canopies designed to shield us from rain or sun. They come in various styles, from compact travel umbrellas to large beach umbrellas. The canopy is typically made of waterproof fabric like polyester or nylon. Modern umbrellas often feature automatic opening mechanisms for convenience. Overall, umbrellas are essential accessories for staying protected in different weather conditions. A 12V battery typically consists of six individual cells, each providing around 2 volts. Commonly used in vehicles, such as cars, motorcycles, and boats, 12V batteries are crucial for starting engines. Lead-acid batteries are a common type

of 12V battery, known for their reliability and affordability. Plastic threads are versatile and durable, making them ideal for various projects. Their flexibility allows for intricate designs and detailed work. They come in a range of colors, making them suitable for creative and decorative purposes. Plastic threads are also lightweight, making them easy to work with and suitable for projects that require mobility. Pipes, short for polyvinyl chloride pipes, are widely used in plumbing and irrigation systems due to their durability and affordability. These pipes are lightweight yet strong, making them easy to transport and install, reducing labor costs and effort.



Fig 4.1 Fabricated Car Cover with side rollers and center attachment for Umbrella



Fig 4.2 Fabricated Car Cover with fully opened mode

V. RESULTS AND DISCUSSION:

The automatic car cover is equipped with a motorized system that drives the movement of the cover. The motor is powered by a rechargeable battery. Frame is placed on the hood of the Car. The cover is typically stored on a roller mechanism. When activated, the motor drives the roller to unroll the cover, extending it over the entire car. The umbrella blooms covering the top of the car cover. The car cover itself is made of a durable, weatherproof material such as polyester. This material provides protection against rain, snow, UV rays, dust, and bird droppings, keeping the car clean and protected. When the switch is pressed again the roller mechanism pulls the cover back upwards and the umbrella comes to its original shape.

The selected mechanism ensures the satisfactory operation of the car cover. • The properties of polypropylene-based non-woven fabric materials are carefully chosen for the covering sheet. These materials offer durability, water resistance, and UV protection, ensuring the car remains shielded from various environmental elements while also being lightweight and easy to handle. • The time taken for the car to be covered is a swift 12 seconds, highlighting the efficiency and convenience of the automatic car cover system. • The automatic car cover has been securely placed on the car, demonstrating its ease of use and effectiveness in protecting the vehicle from the elements

VI. CONCLUSION:

The study's findings present a comprehensive evaluation of the selected mechanism for the car umbrella, highlighting its commendable performance in providing adequate coverage and protection for vehicles. Through meticulous analysis, it is evident that the chosen mechanism operates satisfactorily, meeting the demands for shielding cars from various environmental factors. In examining the properties of polypropylene-based non-woven fabric materials for the covering sheet, the study identifies several promising characteristics. These include notable traits such as water resistance, durability, and lightweight construction. Such qualities not only ensure the effective protection of the vehicle but also contribute to the overall efficiency and longevity of the car umbrella system.

The swift covering time of 12 seconds stands out as a significant advantage of the automatic car cover. This rapid functionality enhances the practicality and convenience of the system, making it a compelling choice for car owners seeking efficient and hassle-free protection for their vehicles. Furthermore, the visual representation of the automatic car cover serves to reinforce its usability and effectiveness. By showcasing the seamless integration of the cover onto the car, the study underscores the user-friendly nature of the mechanism and its ability to provide robust protection without compromising on aesthetics. In conclusion, the study's comprehensive analysis underscores the successful implementation of the car umbrella mechanism. The favorable findings support its potential for widespread adoption in the automotive market, where the demand for innovative and reliable vehicle protection solutions.

VII. ACKNOWLEDGMENT

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