Automatic Waterproof House While Raining

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Abstract:- **The ad hoc nature of rains pose a serious challenge in our everyday lives, right from preventing the clothes from getting wet to save precious harvest from drenching. Our innovation addresses this challenge by automatically detecting the downpour and providing a waterproof housing for the object of interest. Our project not only focuses on clothes hung on the cloth line. It basically overlooks upon the vast effects of rain on the materials exposed to the atmosphere. This project focuses on retractable rooftops on the terraces at the time of rains which work on rain sensors.**

I. INTRODUCTION

1.1 Problem Statement

Usually during rains, the clothes and other commodities such as agricultural harvests, food products etc., exposed outdoors for drying will get wet and will be unfit to use. Ourinnovation addresses this challenge by automatically detecting the raindrops and providing a waterproof housing for the object of interest.

1.2 Objectives

The main objective of our project is to find the solution for the above stated problem.

The solution must be economically feasible.

The product must have a global reach.

The materials used must be easily available and economically feasible.

As said above the process shouldn't be cumbersome.

To cope up with the technical glitches in our product.

To make this product durable and reliable,

1.3 Scope of our Project

Our project not only focuses on clothes hanged on the clothesline. It basically overlooks upon the vast effects of rain on the materials exposed to the atmosphere.

This project focuses on retractable rooftops on the terraces at the time of rains which work on rain sensors.

• Agricultural produce of the most value need to be saved from unexpected rain, not able to cover them yields a devastating result of decay and rotting of harvest.

Not only had the above stated, this project can be used vastly due to its economical feasible nature.

1.4 Construction and Working Principle

Our equipment consists of

* A pair of steel shaft

• Steel support structures

Rexine waterproof sheets

• Nylon spur gear (pair)

Two pairs of Ball bearings

Washers, stoppers, fasteners

A pair of PVC shafts

• 12 stepper motor

• 12v battery

1.298N H bridge (120)

Arduino MC

Rain sensor

Integrated Touch sensor consisting of following components

Transistor

1K ohm resistor

Conducting material (Cu)

Empty circuit board

1.5 Component Specification:

1.5.1 H-Bridge:

An H bridge is an electronic circuit that switches the polarity of a voltage applied to a load. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards.

Most DC-to-AC converters (power inverters), most AC/AC converters, the DC-to-DC push–pull converter, most motor controllers, and many other kinds of power electronics use H bridges. In particular, a bipolar stepper motor is almost invariably driven by a motor controller containing two H bridges.

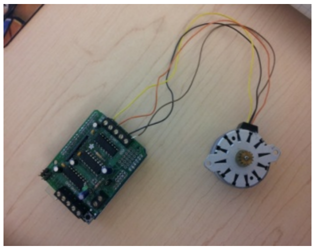


Fig 1.5.1 H-bridge motor driver

1.5.2 Touch sensor

Touch Sensors are electronic sensors that can detect touch. They operate as a switch when touched. These sensors are used in lamps, touch screens of the mobile, etc… Touch sensors offer an intuitive user interface.Touch sensors work similar to a switch. When they are subjected to touch, pressure or force they get activated and act as a closed switch. When the pressure or contact is removed they act as an open switch.Capacitive touch sensor contains two parallel conductors with an insulator between them. These conductors plates act as a capacitor with a capacitance value C0.

When these conductor plates come in contact with our fingers, our finger acts as a conductive object. Due to this, there will be an uncertain increase in the capacitance.

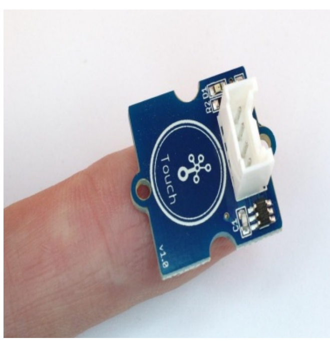


Fig 1.5.2 Touch sensor

A capacitance measuring circuit continuously measures the capacitance C0 of the sensor. When this circuit detects a change in capacitance it generates a signal.

1.5.3 Spur Gear:

Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Though the teeth are not straight-sided (but usually of special form to achieve a constant drive ratio, mainly involute but less commonly cycloidal), the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts.No axial thrust is created by the tooth loads. Spur gears are excellent at moderate speeds but tend to be noisy at high speeds.

Fig 1.5.3. Spur gear

1.5.4 PVC Shaft:

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power.The various members such as pulleys and gears are mounted on it.

1.5.5 Stepper Motor:

A stepper motor, also known as step motor or stepping motor, is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

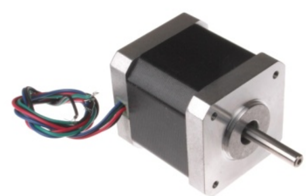


Fig 1.5.5 Stepper motor

Switched reluctance motors are very large stepping motors with a reduced pole count, and generally are closed-loop commutated.

1.5.6 Battery:

An automotive battery is a rechargeable battery that supplies electrical current to a motor vehicle. Its main purpose is to feed the starter, which starts the engine. Once the engine is running, power for the car's electrical systems is supplied by theAn automobile battery is an example of a wet cell battery, with six cells. Each cell of a lead storage battery consists of alternate plates made of a lead alloy grid filled with sponge lead (cathode plates) or coated with lead dioxide (anode). Each cell is filled with a sulfuric acid solution, which is the electrolyte. Initially, cells each had a filler cap, through which the electrolyte level could be viewed and which allowed water to be added to the cell. The filler cap had a small vent hole which allowed hydrogen gas generated during charging to escape from the cell.

Fig 1.5.6 Battery

The cells are connected by short heavy straps from the positive plates of one cell to the negative plates of the adjacent cell. A pair of heavy terminals, plated with lead to resist corrosion, are mounted at the top, sometimes the side, of the battery. Early auto batteries used hard rubber cases and wooden plate separators. Modern units use plastic cases and woven sheets to prevent the plates of a cell from touching and short-circuiting.

II. WORKING

When a raindrop falls on the rain sensor, it senses the wetness on its surface and Sends the message to the Arduino microcontroller. This microcontroller will run The motor, as it is powered by a battery. Number of revolutions and speed of the Motor is programmed in the microcontroller. The power is transmitted to the shaft through the gears. As the shafts rotate, the shafts attached to the bottom of the waterproof sheet will slide over the guiding frame and thus, an automatic waterproof housing while raining is achieved. When the surface of the rain sensor dries, the housing will roll up, as it is programmed in the microcontroller. When the microcontroller reboots, then it will never know where exactly the guiding shaft (PVC) lies.

It follows the same action irrespective of the guiding shaft position. In order to resolve this issue, we have incorporated a touch sensor and thus, it is easy for the micro controller to verify the guiding shaft position and work accordingly.

III. APPLICATIONS

Our project not only focuses on clothes hanged on the clothesline. It basically overlooks upon the vast effects of rain on the materials exposed to the atmosphere.

This project focuses on retractable rooftops on the terraces at the time of rains which work on rain sensors.

Agricultural produce of the most value need to be saved from unexpected rain, not able to cover them yields a devastating result of decay and rotting of harvest.

IV. DESIGN CALCULATIONS

Design For Shaft

Considerations:

Power of battery 2.54 Wf

Rpm of shaft = 100

Bending Stress 160 MPA

Shear Stress SOMPA

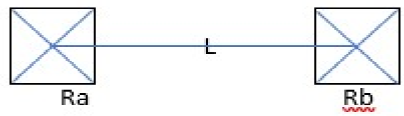
Calculation for shaft diameter for power transmission:

9.55 10 P 9551024103

T=100

T=229.2mm

167162292



RA-Rb=5* 98134905 N

RB=0

RA= 57cm

Ma = 0

2285102 = Rb 57. 10-2

Rb=IN

Similarly Ra= IN

Design For Pillar (Large Scale)

Rb =IN

Similarly Ra= IN

Design For Pillar (Large Scale)

Distance between two pillars = 9144mm

Height of the pillar 1981.2mm

Diameter of the pillar 25.4mm

Thickness 2mm

Outer Radius = 12.7mm

Inner Radius 10.7mm

Capacity of the pillar = nh (R -r)

nx 1981.2 x 12721074

= 2.910 x 10 mm3

Design Calculation of Nylon Spur Gear:

Specifications of gear:

Module (m) = 2.5 mm

Center distance (a) = 150 mm

Pressure angle (a) = 20 degree

Power (P) = 2.25 Kw

Speed (N) = 750 rpm

Design Calculation:

Power (P) = 2**N*T/60 2250 = (2**750*T)/60 T = (2250*607 (2**750)

Torque = 2864788 N-m

Torque T = F * (d/2)

Force F = T/(d/2) = 2864788 /0.075

Force F 38197185 N

Calculation of tangential load:

P/v Ko

P= power

pitch line velocity

Service factor= 1.25 (medium)

V = (A *D* N)/60

V=(n + m * 60 * 750)/ (60 1000)

v=2.356m m/s

Ft =2251000 / 2.356m) 1.25

Ft =1193761 /m

Calculation of initial dynamic load:

Fd Ft * Cv

= (1 + Vm)/(1+0.25 Vm)

Calculation of initial dynamic load:

Fd Ft * Cv

- Velocity factor = (1 + Vm)/(1+0.25Vm)

(1 + 12) /(1 + 0.25 12)

Cv 3.250

Fd 1193761 / m) 3.250

Fd= 3879722 m

Calculation of beam strength:

Fs rimbyob

Face width b = 10m

Allowable static stress ob 58.86 N/m

Form factor = y = 01540912 / 2

y

0.139

s imbyob = 7 *m* 10m 58.86* 0.139

Fs= 257.031m

Calculation of module:

Fs 2 Fd

257.031 m 23879722 /m)

m= 15.094

m=2.471

Take higher standard module m= 2.5

Face width b 10m 25mm

Pitch circle diameter d1= m *zl= 150mm

Pitch line velocity v 5.890 m/s

Recalculation of beam strength:

Fs = nm□yb

Calculation of actual dynamic load:

Fd Ft * Cv

Cv = Velocity factor = (1 + v)/(1+0.25v)

= (1 + 5.890)/(1+0.25 + 5.890)

Cv = 2.787

Ft =p/v = (2.25*1000)/5.890 = 381.97N

Fd 381.97 * 3.250

Fd = 1064.51N

Check for beam strength (tooth breakage):

Fs > Fd

Check for beam strength (tooth breakage):

Fs > Fd

160644106451

The design is safe.

Calculation of wear load:

Fw =d1 *b*Q * kw

Q= Ratio factor

Q=21/(i+1)= 2/(1+1)

Q=1

kw Load stress factor 1.4 N/m2((For non-metallic gear)

Fw=150*25*1*1.4

Fw= 5250 N

Fw Fd

Hence the design is safe

V. BILL OF MATERIALS

Particulars	Prototype cost in Rupees	Large scale product cost in Rupees
Gears		
Shafts	500	2000
Rexine sheets	250	1500
Microcontroller	2000	2000
Stepper Motor	1000	2000
Rain sensor	500	500
Battery	1000	1000
Programming	1000	1000
Fabrication	2500	500
Transportation	500	1000
Miscellaneous	250	500
Grand Total	**10000**	**17000**

VI. CONCLUSION

At last we can conclude that this project has a wide range of acceptance. The possible outcomes of our project are to develop and implement a system that protects vehicles, clothes, and small scale agricultural crops.