

Dimensional Pendulum Rod “RainFlower”

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Abstract—In our daily life, it’s difficult for us to judge the direction where the rain comes because we won’t think of wind direction or speed. We could easily get wet even with an umbrella. Thus, I have designed a dimensional pendulum rod, which enables the cover of the umbrella to face toward the rain all the time and to tilt in light of different levels of wind speed. Attached on the rod, the umbrella’s cover will always be perpendicular to the direction of rain. I named the rod Rainflower because it always rotates to the rain, as if a sun flower faces toward the sun. The product will improve people’s life quality to a great extent.

Index Terms—Real-time measurement of wind direction and speed; Intelligent umbrella; Rain-generated electricity; Two degrees of freedom.

I. INTRODUCTION

IN the heavy rain, we usually see people slant their umbrellas against the wind and raindrops. I initially got the inspiration of this invention under these circumstances: by measuring the real-time direction and velocity of the wind to calculate the slope of the raindrops, the umbrella could rotate its cover toward the direction of the most precipitation—making the cover perpendicular to raindrops’ direction. After all, it’s hard for us to judge the wind by the naked eye. Consequently, my project amounts to an umbrella with a minuscule weather station and a driving force (3 steering machines) which depends on the data collected from the sensors through Arduino to rotate the cover to corresponding angles, realizing the dimensional revolution.

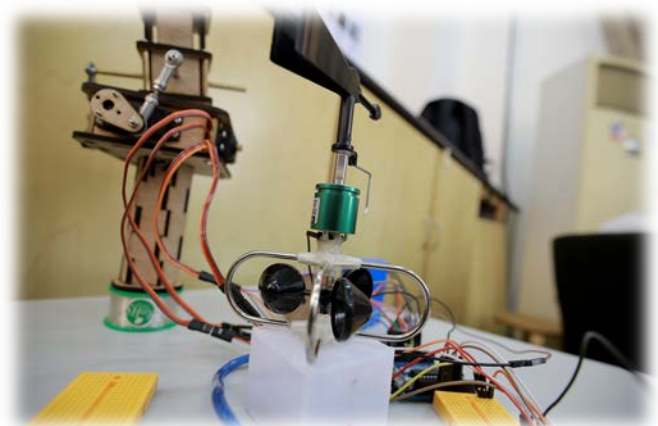
For the moment, however, the so-called “smart” umbrellas are mainly those invented for weather forecast or against missing. None of them have showed the substantial intelligence like Rainflower. Moreover, the techniques of rain-generated electricity at the present stage are mainly achieved by gathering the rainwater on the rooftop and transforming its gravitational potential energy into electricity through turbines, whereas Rainflower makes it possible for raindrops to generate electricity. The cover of the umbrella could be laid with an amount of thin slices, which generate a trace of

electricity through deformations when raindrops falling on them. While its mechanism is quite similar to the previous, current one, this technique makes the rain-power generation much more approachable and indicates the engineering for a sustainable future.

II. DESIGN & MECHANISM

A. Electronic Part

The electronic system address two major problems: the real-time measurement of wind velocity and direction.



1) Wind velocity

The minuscule spherical anemometer drives the axis, as well as the three-quarter disk fixed on it, to rotate simultaneously. An LED light and a photoresistor are on both sides of the disc. Thus when the disc rotates, the resistance of the sensor changes in line with the periodical light through the crack on the disc. Then calculate the period based the values returned by the sensor. Wind speed is obtained eventually, divided into three levels—no wind, breeze and gale.

2) Wind direction

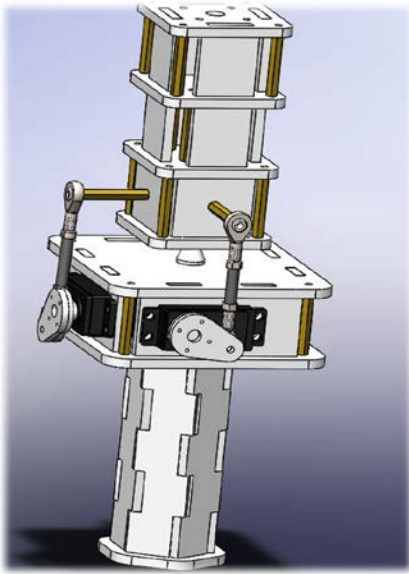
Attached by a weathervane, the Hall Effect angle position sensor (the essence of which is a circular sliding rheostat, the lightest resistor ever found with the least friction of the axis, making possible the smooth rotation of the weathervane and the precise resistance in terms of different wind directions) rotates to the corresponding wind direction. Then Arduino calculates the values returned by the sensor, dividing

them into 8 wind directions—north, northeast, east, southeast, south, southwest, west and northwest.

Finally, all the parameters given by the electronic system gives direction to the steering machines, which rotates the umbrella to the required direction and slope.

B. Mechanical Part

The overall design of the pendulum rod is composed of a handle, a base above with 3 steering machines inside and the structure on the top to fix the umbrella. There is a universal joint between the upper and lower part. The steering machines enable the rod to swing laterally or longitudinally.



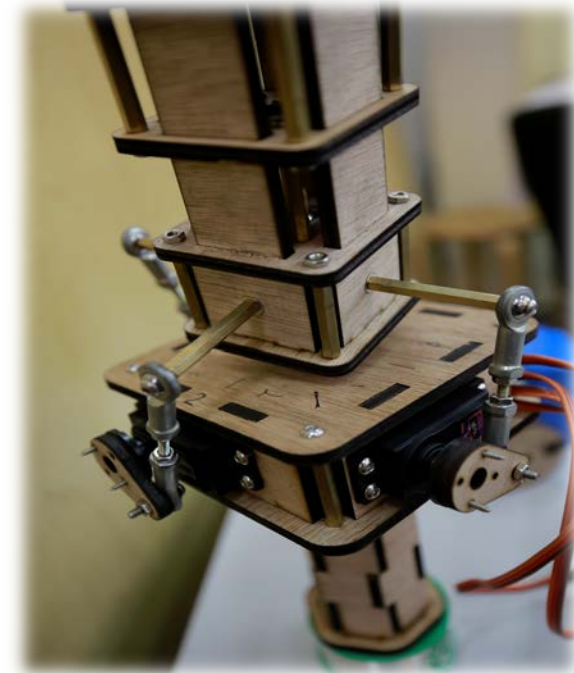
III. CONCLUSION & PROSPECT

The project Rainflower eventually realize the goal of swinging and slanting in two degrees of freedom in the light of the real-time measurement of the direction and velocity of the wind. The original intention of this design is to facilitate people with an umbrella during the rainy days, without the trouble of getting soaking wet.

Besides the basic functions, such an intelligent dimensional pendulum rod has a promising future in other fields. As far as I am concerned, it is equally valuable in terms of energy and the voyage. Since the umbrella always faces toward the direction of the most precipitation, if applied with a few slices which generate electricity through the deformation caused by raindrops (the technique was already developed by French microelectronics engineers), the cover will truly realize the rain-generated electricity. Plus, the design of such a pendulum rod could be applied to ships, boosting the

safety of automatic driving in a rainstorm.

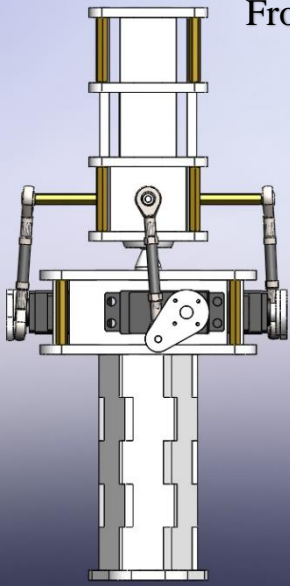
IV. PROTOTYPE



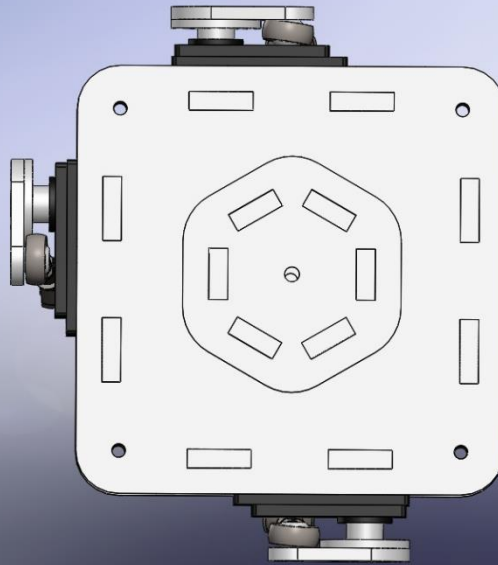
Engineering Drawings of Rainflower

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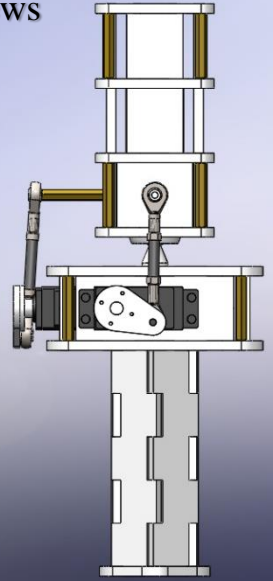
Front Views



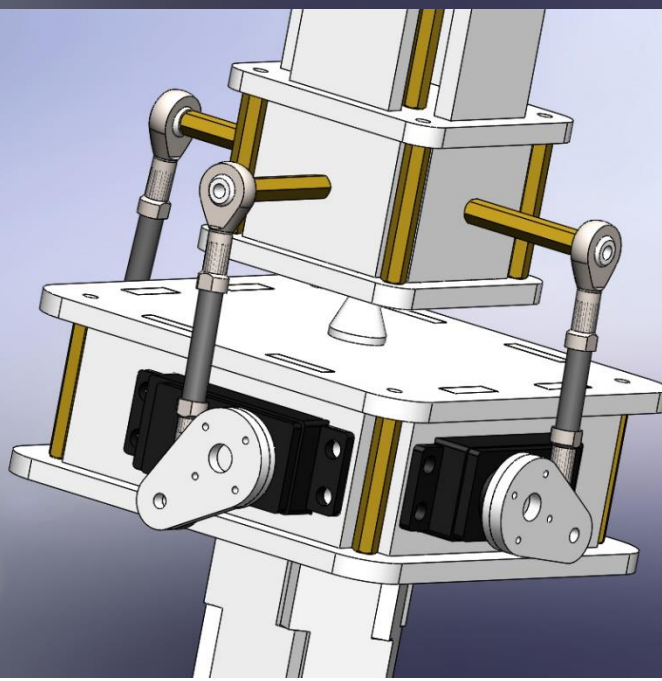
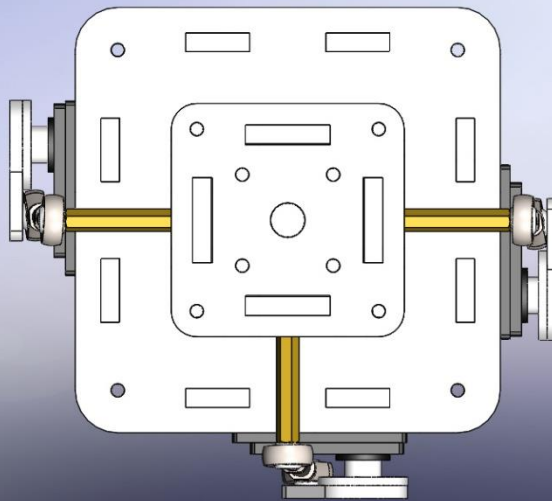
Bottom Views



Right Views



Top Views



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