Diffuse Solar Energy Measurement on Vertical Surfaces: Instrument Design

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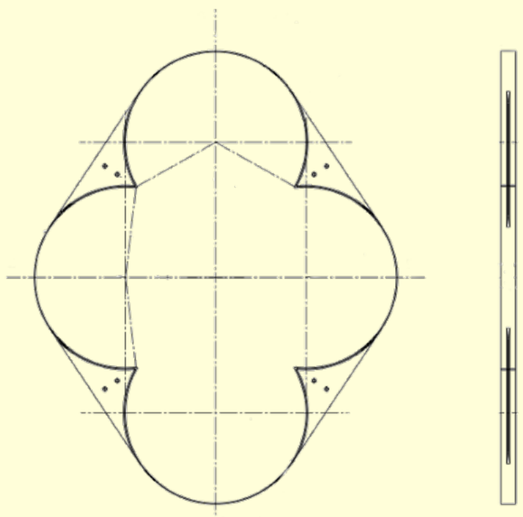
1. INTRODUCTION AND PROBLEM APPROACH

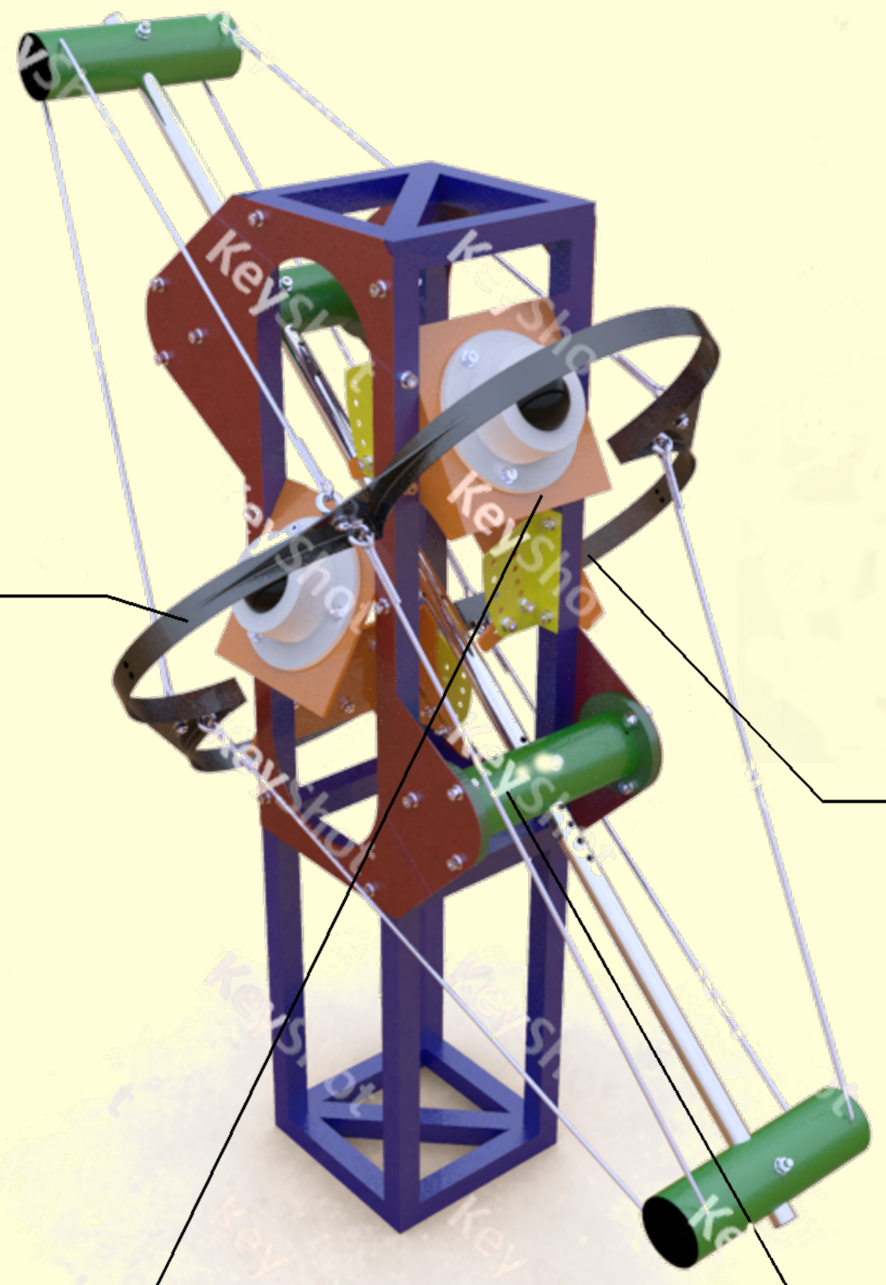
Currently, different instruments and methodologies for measuring solar diffuse radiation can be found, but most of them are only able to operate on horizontal or South facing tilted surfaces. In this paper, we present a new device concerned in order to **measure, in an inexpensive and easy way, solar diffuse radiation on different faced and tilted planes**. The proposed prototype can measure, in one single step, diffuse radiation from 60 up to 90 degrees tilting angles facing the four main cardinal directions: North, South, East and West.

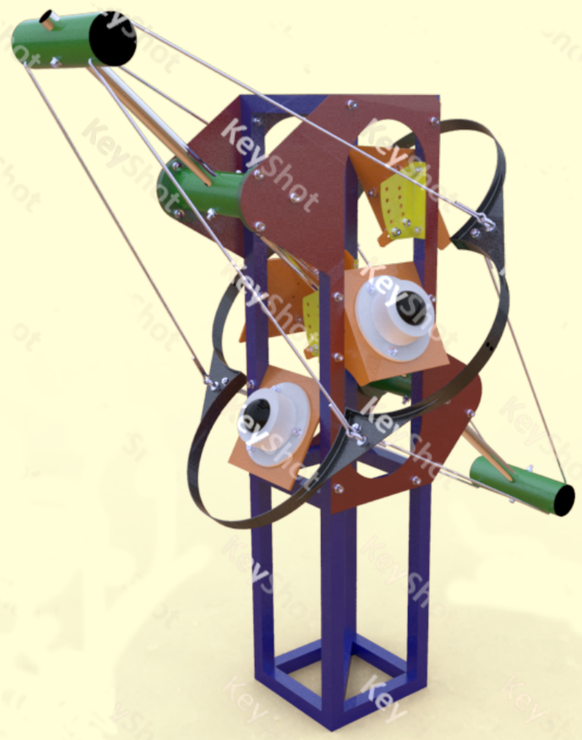
2. DESCRIPTION OF THE PROTOTYPE



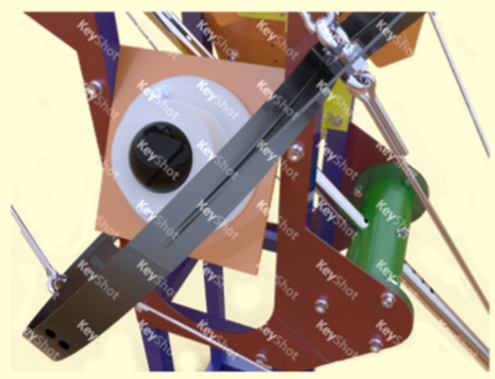
The shadow ring has as many lobes as installed pyranometers in the device.

Picture of the mounted device on the rooftop at the University of Burgos' facilities.





Each sensor can modify singly the tilting angle saving its relative position to the shadow ring.



The shadow ring position can be easily adjusted in one step along the year.

3. CHARACTERISTICS

Property [units]	Value
Maximum height [mm]	1279
Maximum width [mm]	720
Maximum depth [mm]	1114
Pyranometers [units]	4
Lobe's radius (R) [mm]	180
Ring's width (W) [mm]	30
W/R [-]	0.167
Positions/year	8x2
Ring's displacement [mm]	140
Minimum tilting angle [deg]	60
Maximum tilting angle [deg]	90
Tilting step [deg]	7.5

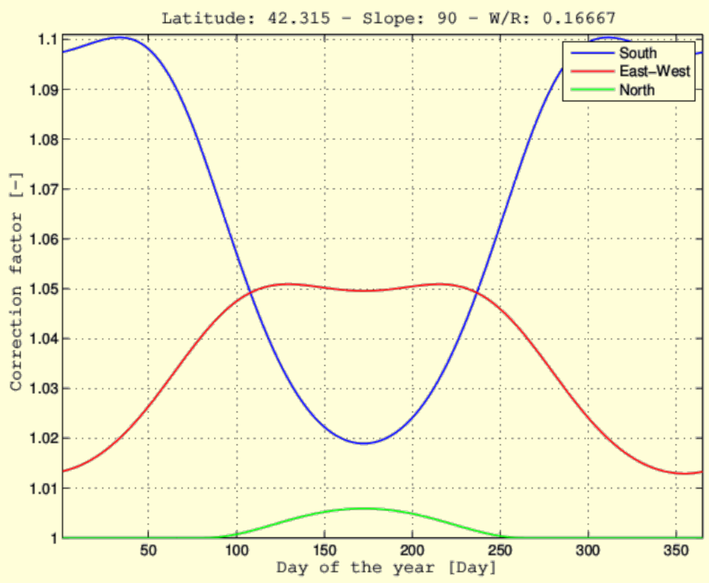
**PATENT PENDING. Ref.: P201400714.*

4. GEOMETRICAL CORRECTION FACTOR

Due to the solid angle blocked by the shadow ring it results mandatory to apply a geometrical correction factor (f_c) which allows us to estimate the real value of the diffuse radiation measurement over the study plane (D_r) once we have measured it with the described device (D_m):

$$D_r = \frac{2\pi}{2\pi - x} D_m = \frac{1}{1 - S} = f_c D_m$$

where x is the solid angle measured in [sr] blocked by the shadow ring and S is the fraction of the sky radiation intercepted by the blocking element.



MAIN REFERENCES

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