DS_WINDY

Hybrid VAWT Turbine — Innovation Summary

Troposkein Darrieus + Twisted Savonius + Wind Lens | Confidential

System Overview

DS_WINDY is a hybrid vertical-axis wind turbine combining a troposkein Darrieus rotor (lift-based, outer) with a twisted Savonius rotor (drag-based, inner) on a single shaft, augmented by a Wind Lens flanged diffuser. The system is designed for low-wind IoT and off-grid applications, with rated output of 68 W at 3.3 m/s and total efficiency of 46%. Key dimensions: 1500 mm max diameter, 1000 mm working height, 24.2 kg total weight.

Patentable Innovations

Items 1–2 are independently novel with patent applications filed. Item 3 strengthens as a system-level claim. Items 4–6 are dependent claims within the system patent. Item 7 qualifies as a separate utility model.

#	Innovation	Description	IP Status
1	**Natural Flow Circulation**	Synchronized 90° twist of both rotors (Darrieus + Savonius) creates a closed-loop airflow path without guide vanes. Wind enters from above, spirals through the outer Darrieus rotor, transfers to the inner Savonius, exits downward through a collector which generates suction for fresh intake. Eliminates 18–24 guide vane components. Transition losses reduced from 35–40% to 5–8%.	Patent pending
2	**Variable Angle of Attack Along Troposkein Height**	Three-zone static AoA optimization (10° lower / 8° middle / 6° upper) compensates for varying tangential velocity along the troposkein profile. Smooth sigmoid transitions between zones. No known production VAWT implements static variable AoA on a troposkein blade.	Patent pending
3	**Hybrid Troposkein Darrieus + Twisted Savonius on Single Shaft**	Coaxial configuration: outer lift-based Darrieus (R_{max} = 750 mm) and inner drag-based Savonius (R = 242 mm) with optimized diameter ratio D_{sav}/D_{darr} = 0.43. Savonius provides self-start at 1.3 m/s; Darrieus delivers peak efficiency at working speeds. Both rotors share synchronized 90° twist geometry.	Patentable (system claim)
4	**Toroidal Flow Transition Collector**	Torus geometry (R_{major} = 320 mm, r_{minor} = 82 mm) at z = 1100 mm provides constant cross-section flow turning from Darrieus exit to Savonius inlet with minimal separation losses. Clearance to Savonius rotor: 4 mm (verified).	Dependent claim
5	**Integrated Wind Lens Diffuser with Generator Housing**	Flanged diffuser (throat R = 252 mm → exit R = 550 mm → flange R = 700 mm) produces 1.4–1.6× velocity amplification and 2.2–2.8× power gain. BLDC generator housed inside diffuser body at z = –200 mm, eliminating aerodynamic drag from external generator placement.	Dependent claim
6	**Troposkein-Profiled Savonius Rotor**	Inner rotor follows modified troposkein curve $r(z) = R \times \sqrt{[1 - 1.5(2z/H - 1)^2]}$ with compression factor 1.5 instead of standard cylindrical shape. Matches radial flow profile exiting the outer Darrieus troposkein, reducing transition zone losses.	Dependent claim

7	**IoT-Integrated Autonomous Control (Raspberry Pi 5)**	Full sensor suite (Hall RPM, I2C anemometer, ACS712 current, DS18B20 temperature, ADXL345 vibration) driving zone-weighted MPPT algorithm with automatic safety response (braking >200 RPM, furling >12 m/s). Self-powered by the turbine via LiFePO4 buffer.	Utility model