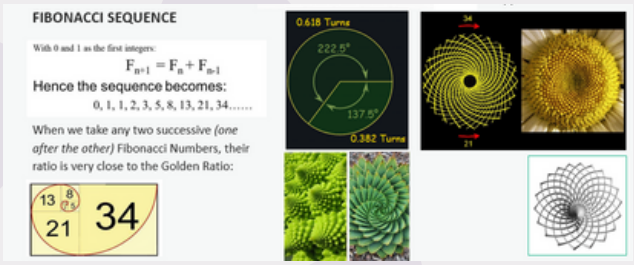
Phyllotaxis Bloom: A Kinetic Sculpture Inspired by Nature


[1]


[2]

KID: 20240325

Nature reveals its most fascinating patterns through phyllotaxis, the precise spiral arrangement of leaves, scales, and florets. Inspired by these intricate natural forms, our project, "Phyllotaxis Bloom," transforms mathematical beauty into a captivating kinetic sculpture. Using the Fibonacci sequence and the golden ratio—137.5° between successive florets—we digitally modelled and fabricated a rotating bloom



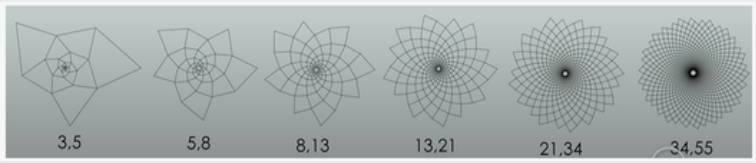
The kinetic effect is enhanced by integrating electronic components controlled via an Arduino Uno microcontroller. A 12V DC motor spins the bloom, with rotation speed finely tuned using a potentiometer. Ultrasonic sensors initiate the rotation based on proximity, activating LED strobe lights synchronized precisely to the bloom's rotation speed. This synchronization creates the illusion of motion or static blooming depending on the strobe frequency.

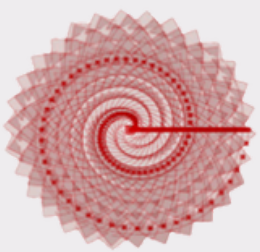
A WS2812B RGB LED matrix and a white LED panel alternate to produce stunning visual effects, changing colors and frequencies, further enriching the sculpture's dynamic appeal. Key electronic components include ultrasonic sensors, a 16x2 LCD for displaying rotation speed and strobe frequency, and the L298N dual H-Bridge motor driver for precise motor control.

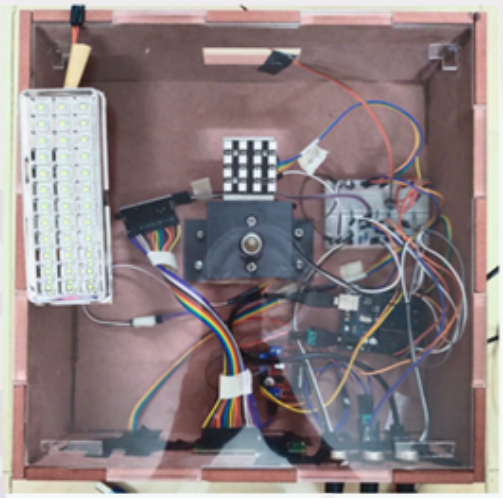
Laser-cut acrylic and CNC-machined MDF form the robust housing, ensuring both durability and aesthetic appeal. The entire system emphasizes digital craftsmanship, combining subtractive and additive manufacturing techniques seamlessly.

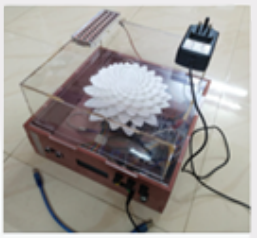
Through experimentation, we discovered a mathematical relationship between the bloom's spiral pattern, rotation speed (RPM), and strobe frequency (Hz). Specific RPM and strobe frequency settings produced clear, compelling blooming illusions, while deviations caused blur or static patterns. This interaction was defined by the formula:
Strobe Frequency (Hz) = k × (n/number of petals) × (RPM/60)
Our findings offer valuable insights for creating controlled visual experiences and potential applications in architectural facades and renewable energy harvesting devices, as demonstrated by innovative concepts like the Airiva wind turbine wall.

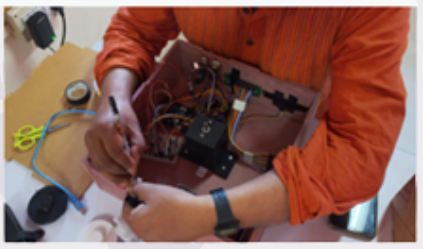
This sculpture comprises petals arranged in intersecting spiral patterns, creating mesmerizing optical illusions when viewed under strobe lights. The bloom's petals were generated using Rhino software and subsequently 3D printed on a Creality Ender 3 Neo printer. This popular Fused Deposition Modelling (FDM) printer offers precision, ease of use, and material versatility, making it ideal for intricate designs.











[1] Mr Pradipta Roy Choudhury
PhD Scholar
[2] Dr Shiva Ji, Associate Professor
Department of Design