The Implantation of the Phototaxic Behavior of Physarum polycephalum in a Decentralized Robotics System

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This project investigated how simple behaviors can be implemented into an interconnected decentralized swarm robotics system to generate complex emergent behaviors without using extensive coding or sensors often required by traditional centralized robotic systems. To accomplish this, an interconnected decentralized swarm robotics was designed that mimicked the phototaxic behavior of the natural decentralized system Physarum polycephalum. This behavior was first quantified by measuring the expansion of Physarum polycephalum specimens on 2% non-nutrient agar for 24 hours under varying light intensities. A quadratic equation of best fit generated from this data was used to determine the rate each module in the system should expand when exposed to different light intensities. When analyzed, it was apparent that the system not only exhibited the simple phototaxic behavior previously observed in P. polycephalum, but also displayed more complex emergent behaviors of the organism such as branching expansion at low light intensities, linear expansion at high light intensities, oscillatory movement, and the ability to overcome obstacles without the use of obstacle sensors. This shows that this interconnected decentralized swarm robotics system can accurately mimic a natural decentralized system and perform navigation tasks without complex programming, obstacles sensors and or tethers often required by centralized systems. Further development of this project could lead to a system that is capable of autonomously navigating and collecting data in hostile environments with minimal amounts of sensors and code.

Awards Won:

Fourth Award of $500