CrabTech: A Smart System for Pre-Molt Detection and Monitoring in Soft-Shell Rice Field Crab Production Using Behavioral and Morphological Indicators

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The rice field crab, Sayamia bangkokensis , is a freshwater semi-terrestrial crab with growing commercial significance, especially in soft-shell crab production. These crabs must be harvested immediately after molting, making them a highly valued, affordable, and protein-rich food product. This farming practice can raise marketing value by up to 600% and offers an important economic alternative as wild populations decline. However, pre-molt identification remains a major challenge due to the lack of efficient monitoring tools, forcing farmers to rely on labor-intensive, round-the-clock surveillance and expertise for accurate separation. To tackle this, we developed CrabTech, a novel AI-driven smart system for rapid and improved pre-molt detection and monitoring based on behavioral and morphological characteristics. Our observations indicated that pre-molt crabs exhibited negative thigmotaxis, tending to isolate themselves from the group, along with distinct morphological changes, including 1.5-fold shorter leg flexion, paler coloration with higher lightness, and posterior shells that were 1.2-fold longer than average. In addition, crabs remained in the soft-shell stage for a maximum of 20 minutes before calcification began. These underlying observed patterns were integrated into CrabTech. This innovation achieved 99.4% accuracy, with 100% of the separated crabs successfully molting, while enabling real-time monitoring and automatic alerts to ensure harvest before shell hardening. Compared with traditional methods, the system reduced crab mortality by 2.6-fold, minimized direct handling, and improved sorting efficiency by 3.3-fold. CrabTech enables large-scale batch sorting and provides a potential framework for the efficient soft-shell freshwater crab production.

Awards Won:
Third Award of $1,200