Collaborative Character Drawing with Calmbots

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We introduce Calmbots, insect-based interfaces comprising multiple functions (transportation, display, drawing, or haptics) for use in human living spaces by taking advantage of insects' capabilities. We utilized Madagascar hissing cockroaches as robots because of advantages such as mobility, strength, hiding, and self-sustaining abilities. Madagascar hissing cockroaches, for instance, can be controlled to move on uneven cable-lines floors and push light-weight objects such as tablespoon. We controlled the cockroaches' movement using electrical stimulation and developed a system for tracking and communicating with their backpacks using augmented reality markers and a radiobased station, the steps of controlling multiple cockroaches for reaching their goals and transporting objects, and customized optional parts. Our method demonstrated effective control over a group of three or five cockroaches, with, at least, 60% success accuracy in dedicated experimental environments involving over forty trials for each test. Calmbots could move on carpeted or cable-lines floor and did not become desensitized to stimulation under a certain break interval.

Later, we developed a new optional part and algorithms for the drawing function, which is one of the functions Calmbots has. Our method improved drawing accuracy by using multiple cockroaches and demonstrated effective control over a group of three cockroaches, with, at least, 30% success accuracy in dedicated experimental environments involving over sixty trials for each test.

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