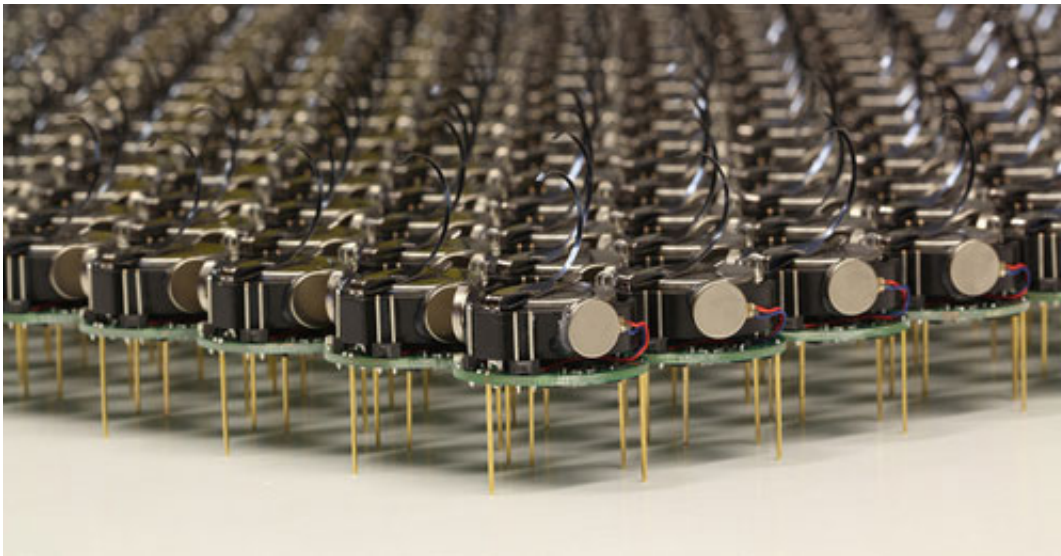# Kilobots - tiny, collaborative robots - are leaving the nest (w/ video)

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The Kilobots are an inexpensive system for testing synchronized and collaborative behavior in a very large swarm of robots. Photo courtesy of Michael Rubenstein

(PhysOrg.com) -- The Kilobots are coming. Computer scientists and engineers at Harvard University have developed and licensed technology that will make it easy to test collective algorithms on hundreds, or even thousands, of tiny robots.

Called Kilobots, the quarter-sized bug-like devices scuttle around on three toothpick-like legs, interacting and coordinating their own behavior

as a team. A [June 2011 Harvard Technical Report](#) demonstrated a collective of 25 machines implementing swarming behaviors such as foraging, formation control, and synchronization.

Once up and running, the machines are fully autonomous, meaning there is no need for a human to control their actions.

The communicative critters were created by members of the Self-Organizing Systems Research Group led by Radhika Nagpal, the Thomas D. Cabot Associate Professor of Computer Science at the Harvard School of Engineering and Applied Sciences (SEAS) and a Core Faculty Member at the Wyss Institute for Biologically Inspired Engineering at Harvard. Her team also includes Michael Rubenstein, a postdoctoral fellow at SEAS; and Christian Ahler, a fellow of SEAS and the Wyss Institute.

Thanks to a technology licensing deal with the K-Team Corporation, a Swiss manufacturer of high-quality mobile robots, researchers and robotics enthusiasts alike can now take command of their own swarm.

One key to achieving high-value applications for multi-robot systems in the future is the development of sophisticated algorithms that can coordinate the actions of tens to thousands of robots.

"The Kilobot will provide researchers with an important new tool for understanding how to design and build large, distributed, functional systems," says Michael Mitzenmacher, Area Dean for Computer Science at SEAS.

"Plus," he adds, "[tiny robots](#) are really cool!"

The name "Kilobot" does not refer to anything nefarious; rather, it describes the researchers' goal of quickly and inexpensively creating a

collective of a thousand bots.

Inspired by nature, such swarms resemble social insects, such as ants and bees, that can efficiently search for and find food sources in large, complex environments, collectively transport large objects, and coordinate the building of nests and other structures.

Due to reasons of time, cost, and simplicity, the algorithms being developed today in research labs are only validated in computer simulation or using a few dozen robots at most.

In contrast, the design by Nagpal's team allows a single user to easily oversee the operation of a large Kilobot collective, including programming, powering on, and charging all robots, all of which would be difficult (if not impossible) using existing robotic systems.

So, what can you do with a thousand tiny little bots?

Robot swarms might one day tunnel through rubble to find survivors, monitor the environment and remove contaminants, and self-assemble to form support structures in collapsed buildings.

They could also be deployed to autonomously perform construction in dangerous environments, to assist with pollination of crops, or to conduct search and rescue operations.

For now, the Kilobots are designed to provide scientists with a physical testbed for advancing the understanding of collective behavior and realizing its potential to deliver solutions for a wide range of challenges.

Provided by Harvard University