Swarm-bot: A Novel Type of Self-Assembling Robot

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Swarm robotics [3] is a relatively new and rapidly growing field in collective robotics. It involves the study of robotic systems made up of cooperating robots. I have been invited here to report on work we carried out in the SWARM-BOTS project, a project funded by the Future and Emerging Technologies program of the European Commission. This work is directly inspired by the collective behavior of social insect colonies and other animal societies [1, 2]. In particular, it focuses on the study of the mechanisms which govern the processes of self-organisation and self-assembly in artificial autonomous agents. In order to pursue these objectives, we developed a new type of robot, called an *s-bot* (see Fig.1, left). The s-bots are mobile robots with the ability to connect to and to disconnect from each other. A swarm-bot is defined as an artifact composed of many assembled s-bots (see Fig.1, right).

Fig. 1. Left: An s-bot. Right: A "star-shaped" swarm-bot composed of 8 s-bots.

S-bots have relatively simple sensors and motors and limited computational capabilities. Using their grippers, s-bots assemble into a swarm-bot that is able to solve problems too difficult for a single s-bot. For example, a swarm-bot could transport an object too heavy for a single s-bot (see Fig. 2, left).

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Or it could navigate in environments where, because of the terrain roughness, an individual s-bot would have major difficulties (see Fig. 2, right).

In the speech, I will first describe the hardware and control algorithms that we developed. I will go on to present video recordings of recent results concerning autonomous self-assembly, coordinated movement, path formation, and collective transport with swarms of up to 20 s-bots. The interested reader can find detailed information about the project in [4, 5, 6, 7, 8]. Pictures and video-recordings are available on the project web site: `www.swarm-bots.org`.

Fig. 2. Left: 6 s-bots, of which 4 in swarm-bot formation, collaborate to transport a heavy object. Right: A 4 s-bots linear swarm-bot moves on rough terrain.

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