MIT researchers devise new means to synchronize a group of robots (w/ Video)

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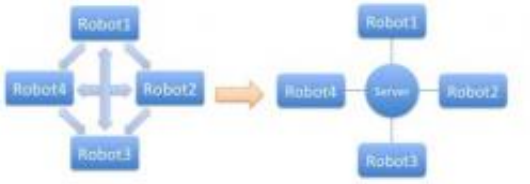

Comparaison of the network topology without (left) or with (right) quorum sensing

(Phys.org) -- For several years, roboticists have been working out ways to get a group of robots to perform synchronized activities as demonstrated most often in dance routines. It's not just about trying to create humanoid machines that can better entertain us though, it's about getting them to perform simple small scale synchronized activities so that a means can be found to scale up such activities so that robots of the future can work together to autonomously accomplish certain goals that have been defined by their human masters. To that end, MIT researchers Patrick Bechon and Jean-Jacques Slotine have been studying ways to mimic so called quorum sensing, which some organisms use to figure out how many of their own kind are around, and then to perform actions based on it. The two have applied this principal to small dancing robots, to stunning effect. They have written a paper describing what they have learned and posted it on the preprint server *arXiv*.

Up till now, most researchers have tried getting robots to move as one by programming them to communicate with one another using various kinds of networks. The drawback is that networks tend to have latency issues, which can cause a robot to get out of synch. Other researchers have tried to preprogram the same routine into each robot and then get them to start at the same time. The problem with that of course, is if one of the robots encounters a problem, such as falling, it won't know how to catch up to the others. To get such around such issues Bechon and Slotine looked at how nature has developed a means to handle the problem.

They noted that bacteria and some insects use what is known as quorum sensing, which is where each of the organisms emit a small number of molecules into the environment which the others can sense. The more members of the group, the more molecules are present, which lets each member know how many others are there and when it's time to do something.

With the robots, the team adjusted a team of dancing robots from robot maker, Aldebaran, so that each would emit data as they danced, indicating where they are in their routine. A central computer listens for the data and computes an average for the group which it sends out into the environment; each robot then listens for that average and keeps itself as close as possible to it. If something happens, say a researcher reaches in and sets one of the robots on its fanny, the robot is able to get up, listen to where everyone else is, adjust its own routine accordingly and then join in with the group, in near perfect synchronization. Eerily similar to how a human being would do it.

More information: Synchronization and quorum sensing in a swarm of humanoid robots, arXiv:1205.2952v1 [nlin.AO] arxiv.org/abs/1205.2952

Abstract

With the advent of inexpensive simple humanoid robots, new classes of robotic questions can be considered experimentally. One of these is collective behavior of groups of humanoid robots, and in particular robot synchronization and swarming. The goal of this work is to robustly synchronize a group of humanoid robots, and to demonstrate the approach experimentally on a choreography of 8 robots. We aim to be robust to network latencies, and to allow robots to join or leave the group at any time (for example a fallen robot should be able to stand up to rejoin the choreography). Contraction theory is used to allow each robot in the group to synchronize to a common virtual oscillator, and quorum sensing strategies are exploited to fit within the available bandwidth. The humanoids used are Nao's, developed by Aldebaran Robotics.

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via ArXiv blog