BittyBuzz: a software stack for μcontroller-powered robot swarms

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Buzz

- A dynamic language for distributed multi-agent systems
- Provides top-down and bottom-up programming: describe collective behavior as well as single device behavior
- A single scripting language across scales
- Based on μcode and a Virtual Machine
- Can be used in several applications as sensor networks, IoT applications, localization, planetary exploration, nanomedicine and others

Problem: **The Buzz virtual machine hardly fits in an average microcontroller due to memory constraints**

BittyBuzz

- A Buzz implementation for resource-constrained systems
- Addresses the gap between large robotic platforms and IoT devices
- Tested on the Kilobot (ATmega 328P, up to 60 Kilobots), the Zooid (Cortex-M0, up to 20 Zooids), and the Crazyflie (Cortex-M4, up to 10 Crazyflies) robots

Main changes

- Dynamic memory management using circular buffers
- Management of swarm network and communication primitives with as little as 2 kB of RAM

BittyBuzz gives distributed intelligence to large networks of **resource-constrained** devices

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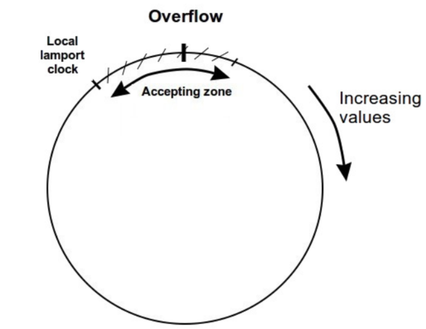
RAM	Flash	Bandwidth
• Closures	• Function vs Macros	• Sorted neighbors
• 2B payload	• Optimized loops	• Ring-buffers
• Unique alloc	• Translated bytecode	



Sizes of BittyBuzz, firmware and bytecode