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Co-operating Robots: Behavior-Based Robots Using Subsumption Architecture

The objectives of this project were to: a) show that robots, using simple behaviors, can solve complicated problems such as a maze, b) compare alternative algorithms for solving mazes, and c) have a robot solve the maze and send the solution wirelessly using Bluetooth to another robot. A robot was built with a light sensor and motors that allowed it to move forward and turn. The robot was programmed with the Java LeJOS API to solve mazes. Four primitive behaviors were coded into the LeJOS subsumption architecture framework: walk on line, get back on line, navigate a cross (junction), and stop on finish. The robot explores the unknown maze, discovering paths and junctions using its light sensor. It uses the Tremaux maze-solving algorithm (depth-first search) and the breadth-first search algorithm to solve the maze. Once the explorer robot searches and solves the maze, it wirelessly transmits the solution via Bluetooth to a worker robot. The worker robot uses the solution to navigate the maze without exploration. To implement this functionality, three behaviors: send solution, receive solution and follow solution path, were programmed into the robots. Two sets of ten experiments were conducted (for each algorithm) with different starting points. The results show that the robot can solve every maze. The Tremaux algorithm is much more efficient than the breadth-first search algorithm, but usually does not find the optimal solution path. The data supported the hypothesis. Two behavior-based robots constructed using the subsumption architecture could solve complex mazes using simple behaviors.