A Fully Automatic Self-Assembling Modular Robot System

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Self-assembling modular robotic systems are a type of swarm robotics that allows for the assembly of different complex robotics configurations. Each system is composed of many individual modules. Each individual module has limited capabilities, however, when assembled with other modules creates a highly adaptive and capable robotics system. Self-assembling modular robots can be used to accomplish tasks in unpredictable environments that require a wide range of capabilities such as search and rescue and infrastructure monitoring. In the logistics industry, self-assembling modular robots can further improve efficiency as it is able to adapt its assembly formation based on the load, minimizing unused capacity. In my project, I present the design and manufacturing of a self-assembling modular robotic system. Each individual robot in the system has 4 degrees of freedom, wheel-based locomotion, Bluetooth and Wi-Fi capabilities, and an electromagnet-based connection system. The system will be controlled through the combined use of AprilTags, computer vision through OpenCV and several PID controllers to determine position and movement instructions. Four of the modules were built. Several validation tests were conducted including testing the speed of the robot in different assembly configurations, speed when loaded with cargo, and the strength of the connection between robots. Test environments were constructed to simulate a challenging environment and to validate the self-assembly performance of the robotic system as a whole.

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