Construction can be optimized by using robotic workers to create structures from smart materials. The prior creation of a construction agent, a robotic inchworm, laid the groundwork for our team to focus on the development of smart building blocks which utilize visual light communication (VLC) and a decentralized planning algorithm. Using a decentralized algorithm allows each agent to act independently with simple rules, creating emergent behavior to build a desired structure using the structure itself as the primary organizer of construction.

**System Design**

**Inchworm construction agents,** designed by the previous team, build structures together using intelligent blocks. These blocks organize construction, as opposed to the builders themselves, utilizing the connected nature of the structure to form an information highway.

**Step 1: Retrieve New Block**

**LOCKING PEGS**

Sub-like feature to align end effector with the block holes when twisted into position.

**PEG OFFSET**

Compensates for various magnet heights on the block.

**PEGGED MAGNETS**

Magnets at 2 different heights used to self align a block into other blocks without concern for orientation.

**FROSTED WINDOW**

Diffuses LED light to improve sensor reading from adjacent block.

**BLOCK COMMUNICATION**

Color sensor looks for change in light value to indicate a message being sent.

**SENDING DATA**

Sensor in block face detects darkness, indicating a neighbor was placed. Starts sending color message.

**LOOKING FOR NEIGHBORS**

Face colors are updated to indicate where neighbors are needed. See legend for block request.

**FEASIBILITY CHECK**

Proposed designs are first ran in simulation. The system is limited by certain rules governing how far blocks can overhang and how much weight they can support. If a structure is analyzed and found to be feasible, each block builds its list of neighbors prioritized in a desired building order based on these constraints and the final blueprint graph is produced. This graph is converted to binary for transmission by the blocks.

**Future Work**

- End Effector
- Inchworm Mobility & Design
- Communication Scalability

**Lessons Learned**

- Remote work hinders integration
- Developing a novel solution requires substantial research
- Asynchronous and decentralized communication takes careful tuning

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