CraftBots AI Challenge Design Spec (WIP)

Overview

The CraftBots AI Challenge is a challenge to create an AI to plan and execute randomly generated tasks in a randomly generated, multi-agent environment.

The problem presented by the challenge will consist of a world modelled as a graph. The randomly generated task will ask the AI to control several actors to collect resources and construct a/some building(s) at specified node(s).

Some of the nodes on the graph will contain different resource mines. These actors can gather resources from these mines and then use them to build the required buildings. Each resource will have different properties to challenge the AI.

There are also several different buildings that can be built. Aside from fulfilling the task specifications, buildings also provide helpful effects to the environment to make your actors perform better. These buildings can be built even if the environment does not require your AI to do so.

Actors

When the simulation starts, the AI will have 3 actors given to them. These actors are controlled by the AI agent you are tasked with designing. They can be controlled to move to different nodes, perform different tasks, such as digging and building, and pick up and put down resources, of which they can carry only a limited amount.

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| **Command** | **description** | **parameters** |
| MOVE | Move between two nodes along an existing connection. | Agent ID  Destination Node ID |
| DIG | Produce one resource at a node that contains a mine of the corresponding type. | Agent ID  Mine ID |
| PICKUP | Pick up one resource. | Agent ID  Resource ID |
| DROP | Drop one resource at the current node. | Agent ID  Resource ID |
| CREATE SITE | Creates a site used to construct a building at the current node | Agent ID  Building Type |
| CONSTRUCT | Build a structure at the current node, up to the percentage of resources that has been deposited into the site. | Agent ID  Site ID |
| DEPOSIT | Deposit resources into a site, to allow the actor to continue constructing the buildings | Agent ID  Site ID  Resource ID |

Resources

There are 5\* different resources that can spawn and be used to construct buildings. These are: Red, Orange, Blue, Black, and Green. Red resources can only be gathered during certain intervals of the simulation. Orange resources require two agents to be mined. Blue resources take considerably longer to gather than the other resources. Black resources take up the entire inventory of the actor, as such, any actor can only carry one Black resource at a time. Green resources decay overtime, and will eventually disappear, if not used.

Resources each take a certain amount of time to mine. Once mined, they are dropped onto the floor. Resources on the floor can be picked up to be moved somewhere else, and resources in an actor’s inventory can be dropped to make space for different resources, or to store them there.

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| **Colour** | **Time to mine** | **Properties** |
| RED | x1 | Can only be mined within known time intervals. The mining action must start and finish within the interval. |
| ORANGE | x1 | Requires two agents to mine. |
| BLUE | x10 | - |
| BLACK | x1 | No other resources can be carried by an agent carrying a single black resource. |
| GREEN | x1 | Decays over time. It will vanish from the node or carrying agent a fixed time after it is mined. |

Buildings

There are 5\* different buildings available. The buildings are: Battery Facilities, Management Buildings, Tool Sheds, Cotton Mills, and Bot Factories. Battery Facilities increase the speed at which actors can move between nodes. Management Buildings increase how fast actors can construct buildings. Tool sheds increase the rate at which resources are mined by actors. Cotton Mills increases the inventory size of actors; however, this does not affect the Black resource’s property of taking the entire inventory space of an actor. Bot Factories, when fully built, allow actors to bring resources into the building to create more actors. This gives the benefit of giving more actors for your AI to use, with the downside of having to manage more actors.

Each building requires a different amount of some/all of the different resources. Buildings take time to build, and can only be built to a percentage equal to the percentage of resources currently given to the building site. Once a resource is placed in a building site it is consumed. Resources can also be placed in the same node as a building site and not be consumed. There can also be more than one building/ building site at one node. Buildings that provide an effect to the actors do so globally, affecting all actors in the simulation.

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| **Building type** | **Resources required** | **effect** | **stacks** |
| Cotton Mill | 4 Red, 2 Blue, 2 Black | Increases the inventory size of all agents by 1 resource. | linear |
| Tool Shed | 1 Red, 4 Blue, 1 Orange | Decreases the time required to mine resources to 0.95x base. | exp |
| Battery Facility | 2 Blue, 2 Black, 2 Green | Increases the speed at which agents move between nodes by 5%. | linear |
| Management Building | 1 Green, 1 Red, 3 Blue | Increases the building speed of actors by 5%. | exp |
| Bot Factory | 3 Green, 2 Black, 2 Orange  (1 Red 1 Blue, 2 Orange, 2 Black, 3 Green for each actor) | Allows actors to deposit resources and build more actors. | N/A |

Other Notes

The CraftBots simulation will have a default set of parameters. However, parameters can be customised to provide different challenges from different aspects of the simulation. There will also be optional rules, such as partial observation, locked-step, and also options to adjust the random generation of the world, including an option to provide a set seed to generate the same map/task.

\*These are subject to change. Resources/buildings may be added, removed, have properties changed, etc.

**Provisional Config File**

Rules:

·         Fully Observable vs Partially Observable\*

·         Realtime vs Lockstep\*

·         Limit on resources on node

·         Limit on resources in mines

·         Building Resource requirements Random vs set

·         Actors working together to mine faster

·         More actors digging at orange mines produces resources faster

·         Black takes up all space in a node (no other resources on the ground with black)

·         Green half-life vs linear decay

·         Green decays when in building site

·         Work together to build faster

·         Max buildings per node

·         Building(s) can be on the same node as mine

·         Can build new actors in white building

·         Need actors to build more actors

·         Work together to build actors together

·         Building Modifier falloff/linear/exponential

Modifiers:

·         Number of Actors

·         Actor Move Speed

·         Actor Inventory Space

·         Actor Build Speed

·         Actor Mine Speed

·         For each resource:

o   Resource Density (how much is created)

o   Resource Mining Modifier

o   Mining Yield

·         Red gathering Intervals

·         Orange: number of Actors to mine

·         Green decay speed in inventory

·         Green decay speed on ground

·         For each building

o   Number of each resource to build

o   Build time

o   Building Modifier Strength (except green)

o   Max Limit of Building

·         Resources to build new actor in green building

·         Time to build actors in green building