

CLAIMS

What is claimed is:

1. A method of generating a contextually-aware digital twin of a commercial real estate building comprising:

receiving, by a computing device, information about an asset comprising one or more devices residing in one or more physical spaces associated with the commercial real estate building;

determining, by the computing device, and based on an identification of the one or more devices of the asset, one or more points corresponding to a sensor or an actuator of the one or more devices;

identifying, by the computing device, and based on the one or more points, at least one controller that serves the asset via the one or more points, wherein the at least one controller comprises a physical or logical entity;

determining, by the computing device, one or more networks, and one or more locations associated with the asset; and

storing, by the computing device, each of the asset, the one or more points, the at least one controller, the one or more networks, and the one or more locations as separate nodes of a graph representation of the commercial real estate building.

2. The method of claim 1, further comprising:

determining, based on an identification of a device connected to a network, whether the device is stored in the graph representation of the commercial real estate building;

based on a determination that the device is not stored in a graph database of the commercial real estate building, identifying the device as a new device;

determining, one or more points corresponding to a sensor or an actuator of the new device;

identifying, based on the one or more points of the new device, at least one controller, at least one location, and at least one network that is associated with the new device; and

storing the one or more points, the at least one controller, the at least one location, and the at least one network associated with the new device in the graph representation of the commercial real estate building.

3. The method of claim 2, wherein the one or more locations comprise a physical or logical location associated with the one or more physical spaces of the commercial real estate building, and wherein the one or more locations comprise at least one of an identification of a floor, a longitude-latitude coordinate, a space, an elevation, a zone, a space zone, and an identification of an occupant of the one or more physical spaces.

4. The method of claim 2, wherein the graph representation of the building comprises a label property graph representation.

5. The method of claim 2, wherein the identifying of the at least one controller associated with the new device is based on information generated by training a machine learning algorithm on one or more previously generated graph representations of the commercial real estate building.

6. A method of asynchronous control of a plurality of Internet of Things (IoT) devices connected to a Building Automation Control (BAC) network of a commercial real estate building comprising:

defining at least one rule comprising at least one first criterion for evaluating data of a first IoT device, and at least one second criterion associated with a determination that the data of the first IoT device does not meet the first criterion;

determining, by a computing device, and based on an evaluation of a first plurality of data of the first IoT device with the at least one first criterion, whether the first plurality of data of the first IoT device meets that at least first criterion;

identifying, by the computing device, and based on a determination that the first plurality of data of the first IoT device does not meet the at least first criterion, one or more second IoT devices to be controlled;

determining, by the computing device, and based on the at least one second criterion, a plurality of actions associated with the one or more second IoT devices;

selecting, by the computing device, one of the actions associated with the one or more second IoT devices; and

controlling, by the computing device, the second IoT device associated with the selected action, to perform the selected action.

7. The method of claim 6, wherein the controlling of the second IoT device associated with the selected action to perform the selected action is based on determining whether a second plurality of data of the first IoT device meets the at least second criterion.

8. The method of claim 6, further comprising:

based on a determination that a second plurality of data of the first IoT device meets the at least second criterion, controlling the second IoT device associated with the selected action to return to a normal operation.

9. The method of claim 6, wherein each of the plurality of devices correspond to an actor in an actor model, and defining the at least one rule for evaluating the data of the first IoT device comprises defining a rule for the actor corresponding to the first IoT device.

10. The method of claim 6, wherein a determination that the first plurality of data of the first IoT device does not meet the at least first criterion comprises evaluating the first plurality of data of the first IoT device within a predetermined time window.