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Status of Robot's Controller with Dynamic Network Model

By

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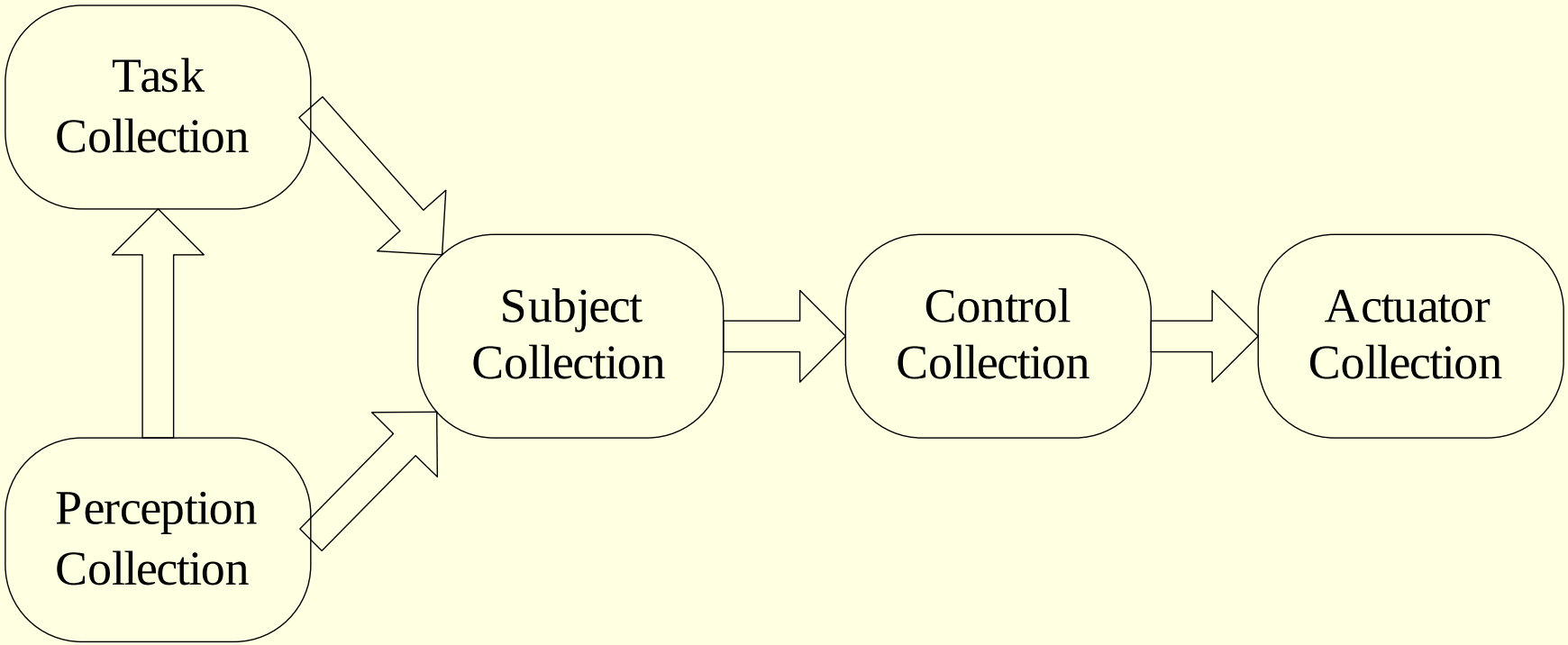
Architecture



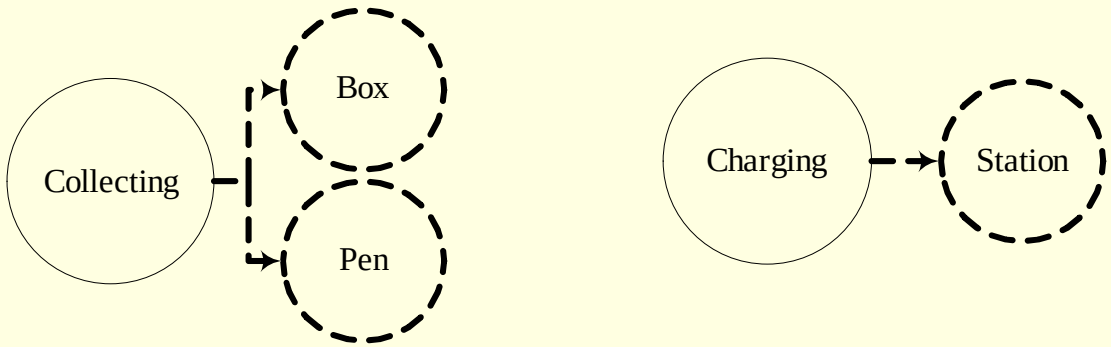
Applying the Architecture

- Assume
  - A robot has to pickup pens on the floor and put into a box and if the power is very low, the robot has to go to charging station.
  - The robot is equipped with a camera, a gripper, a battery, and motors (wheels)
  - Basic Network Structure is supplied by a developer

Network Structure

The Task Collection

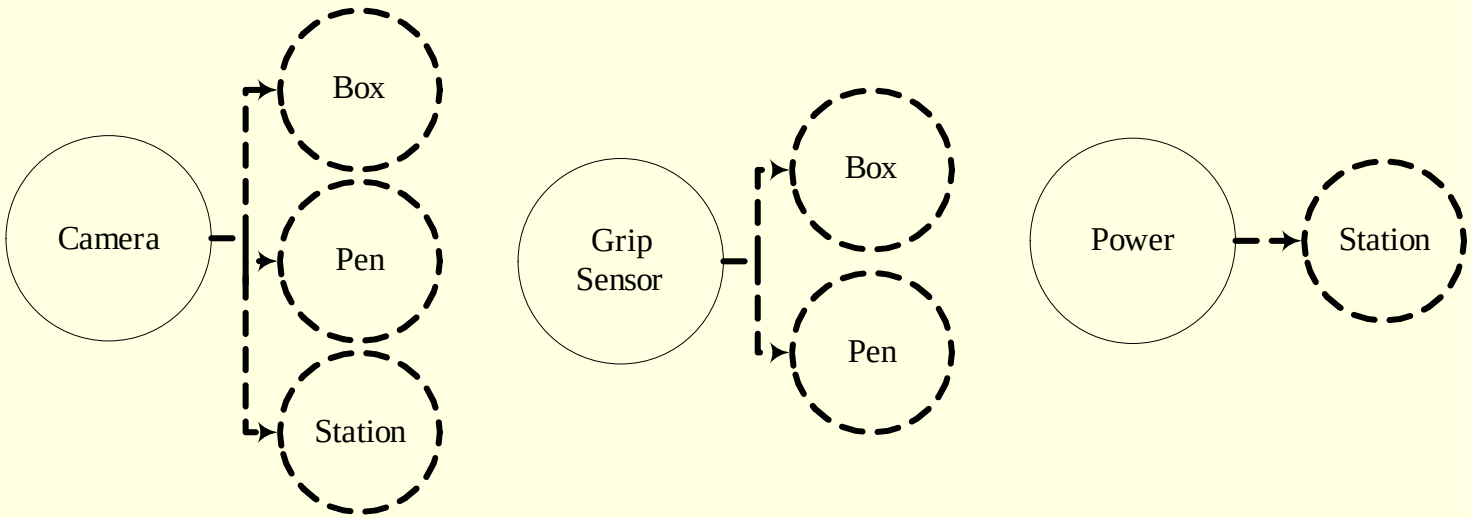
	Box	Pen	Station
Charging (NT:DE)	-	-	LT:LW
Collecting (NT:DE)	LT:LW	LT:LW	-



Network Structure

The Perception Collection

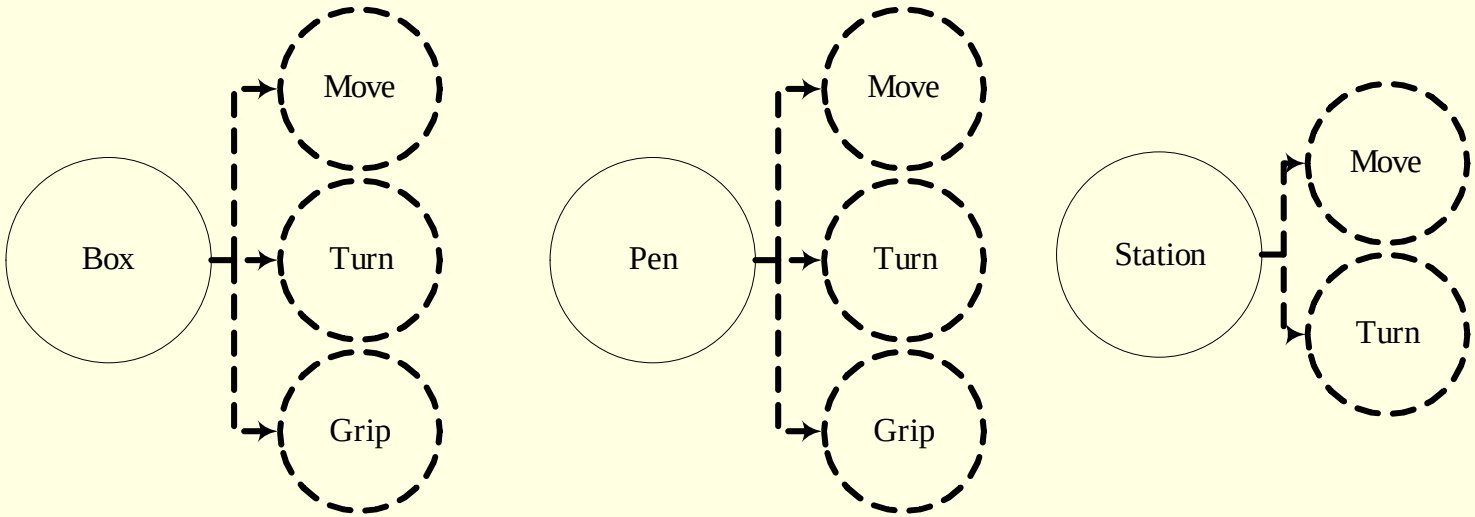
	Box	Pen	Station
Camera (NT:DE)	LT:LW	LT:LW	LT:LW
GripSensor (NT:DE)	LT:LW	LT:LW	-
Power (NT:DE)	-	-	LT:LW



Network Structure

The Interesting Subject Collection

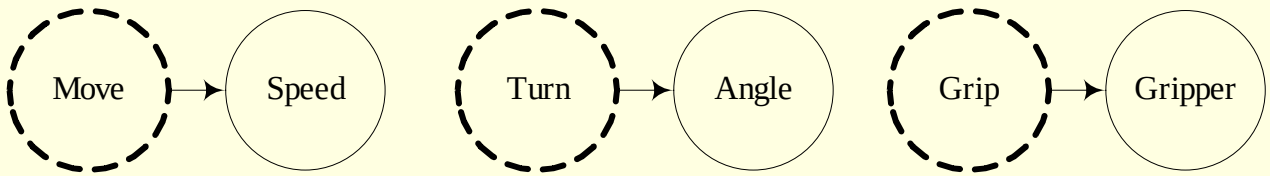
	Move	Turn	Grip
Box (NT:DE)	LT:LW	LT:LW	LT:LW
Pen (NT:DE)	LT:LW	LT:LW	LT:LW
Station (NT:DE)	LT:LW	LT:LW	-



Network Structure

The Control Collection

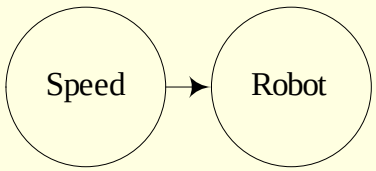
	Speed	Angle	Gripper
Move (NT:DE)	LT:LW	-	-
Turn (NT:DE)	-	LT:LW	-
Grip (NT:DE)	-	-	LT:LW

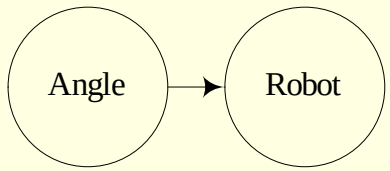


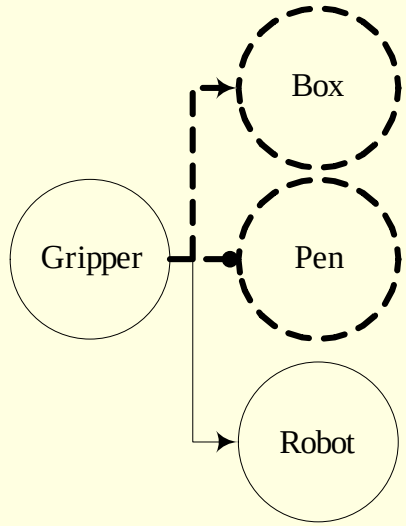
Network Structure

The Actuator Collection

	Box	Pen	Robot
Speed (NT:DE)	-	-	LT:LW
Angle (NT:DE)	-	-	LT:LW
Gripper (NT:DE)	LT:LW	LT:LW	LT:LW







Process of the Model

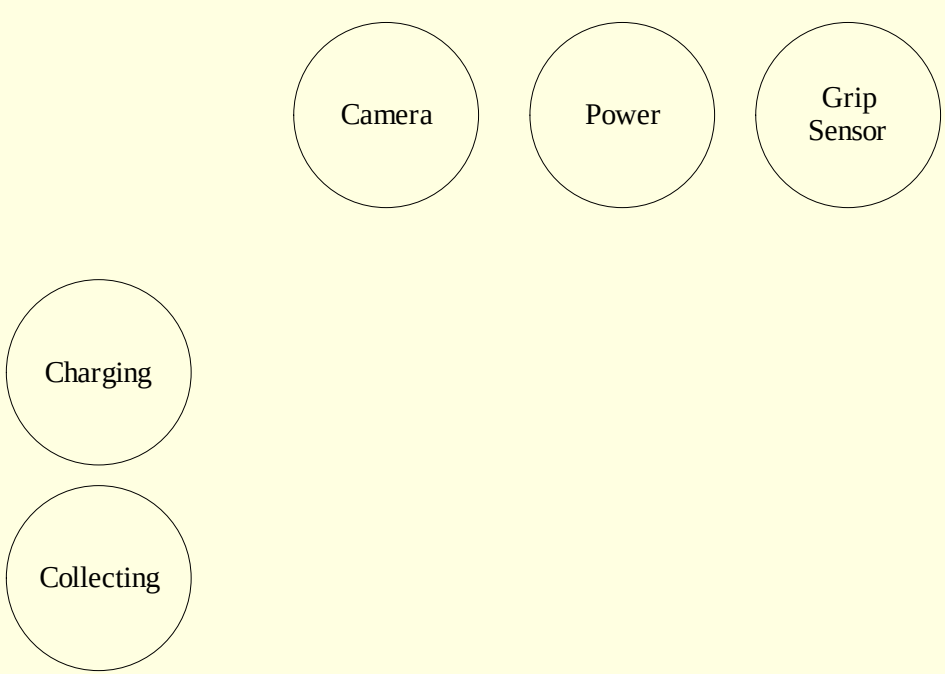
- All static nodes that belong to Task & Perception Collections are created and injected to the network
- During creating process, a connection-request for each output port is submitted to the target manager if the destination node is a static node.
- After the new node is created and injected to the network, it will start its process by checking connection-requests. If there is any, the request will be connected to either a list of input or output port.

Process of the Model

- Next step the node will read degree of execution from all input ports and calculate the average.
- Then the functional unit of this node will be executed (each node will have different functional unit) and generate a degree of execution.
- Finally each node will write the new degree to all output port.

Process of the Model

- Because the output ports of the nodes in Task and Perception Collection are not connected to any static node, the network is not completely connected in this state.



Process of the Model

- If the Camera node sees a pen, a creating-node-request will be sent to the manager that is taking care of creating and injecting a Pen-Subject.
- Since the pen belongs to different collection and it is the dynamic node, the creating process will be different from previous process.
- During creating process, connection-requests will be submitted to managers that are taking care of
  - all static node connected to input ports (Collecting, Camera, and GripSensor)
  - all output ports (Move, Turn, Grip).

Process of the Model

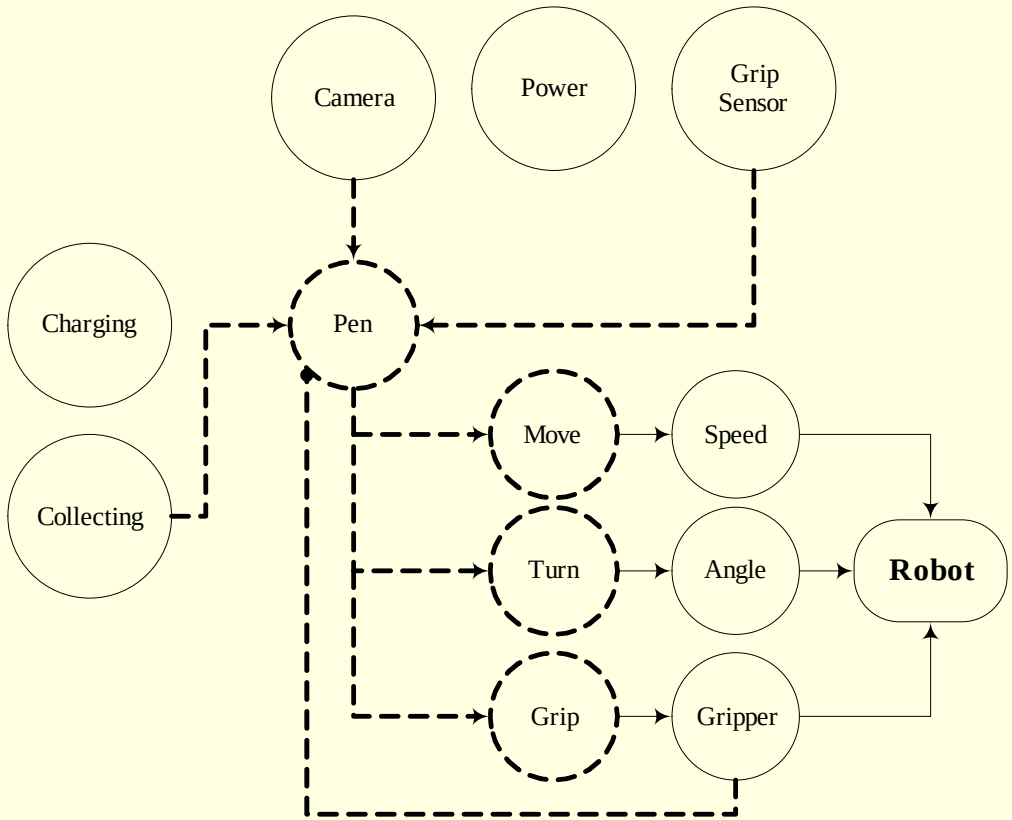
- Since the Collecting, Camera, and GripSensor are static nodes and already injected to the network, the managers of these nodes will forward the connection-request to the node directly.
- But the Move, Turn, and Grip are dynamic nodes, each manager will create a new node and attach the connection request to the new node.
- The creating process will be the same as creating a dynamic node.

Process of the Model

- Since the Collecting, Camera, and GripSensor are static nodes and already injected to the network, the managers of these nodes will forward the connection-request to the node directly.
- But the Move, Turn, and Grip are dynamic nodes, each manager will create a new node and attach the connection request to the new node.
- The creating process will be the same as creating a dynamic node.
- The process will finish when all related nodes are added to the network.

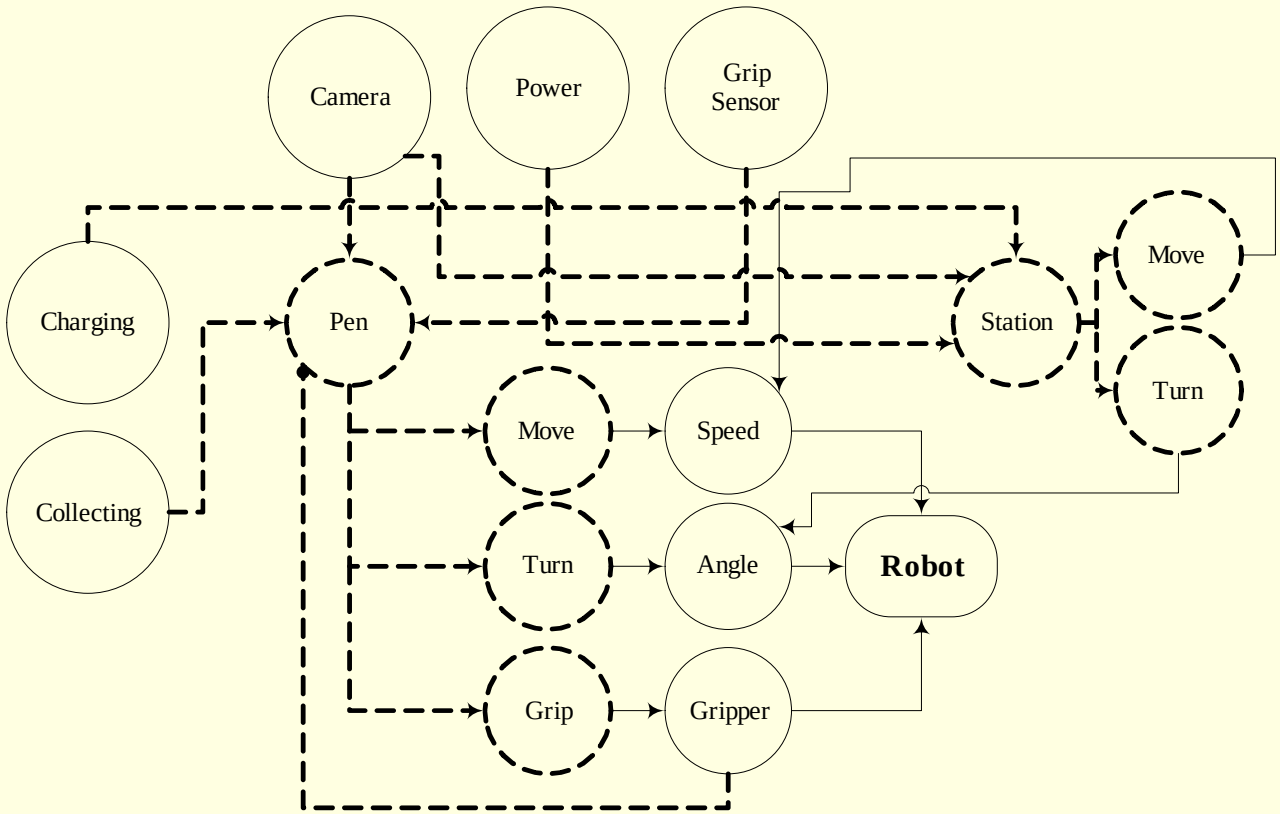
Process of the Model

- Until this state, the result network should look like.



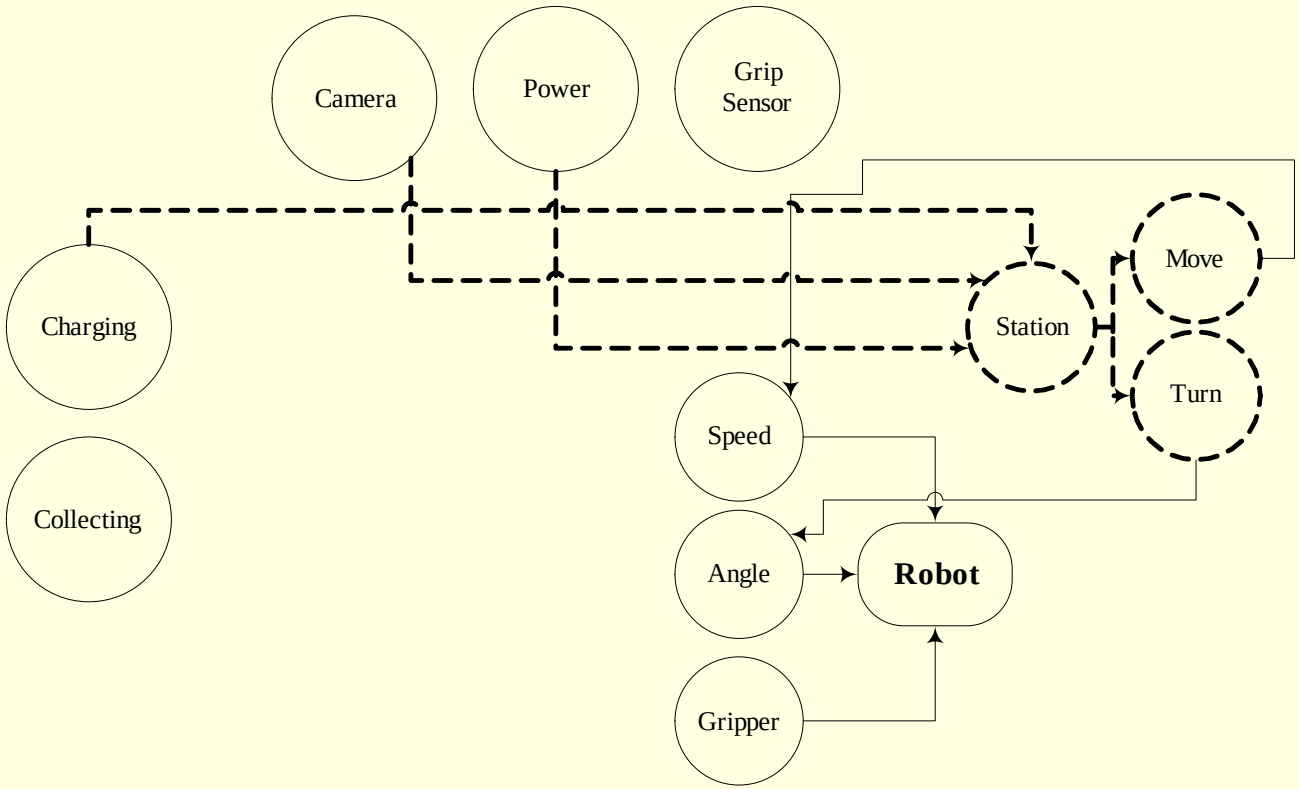
Process of the Model

- If the camera see two subject, a pen and a station, the network will look like



Process of the Model

- If the camera can’t see the pen any more, the result network should look like.



Problems:

- Synchronization among nodes
  - a node reads from the buffer which is not connected by the other end.
  - creating new node while the process of deletion is not finished
- Dead-Lock when nodes are removed from the network.