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CSCI-201

**Factory Design Document: Version 1**

**Purpose:** This piece of software will build the first agent based version of what will become part of a larger glass factory project in version 1.

**Requirements (as stated on the website):**

<http://www-scf.usc.edu/~csci201/factory/TheGlassLine.pdf>

For this version of the project, the following objectives have to be completed:

1. Formulate a Team Interaction Diagram for the whole factory normative scenario.

2. Compile an individual v0 Design Doc, complete with pseudo code, for the agent messaging system.

3. Write up the agent code for the design, and then Unit test it to make sure that it works.

**Acronyms:**

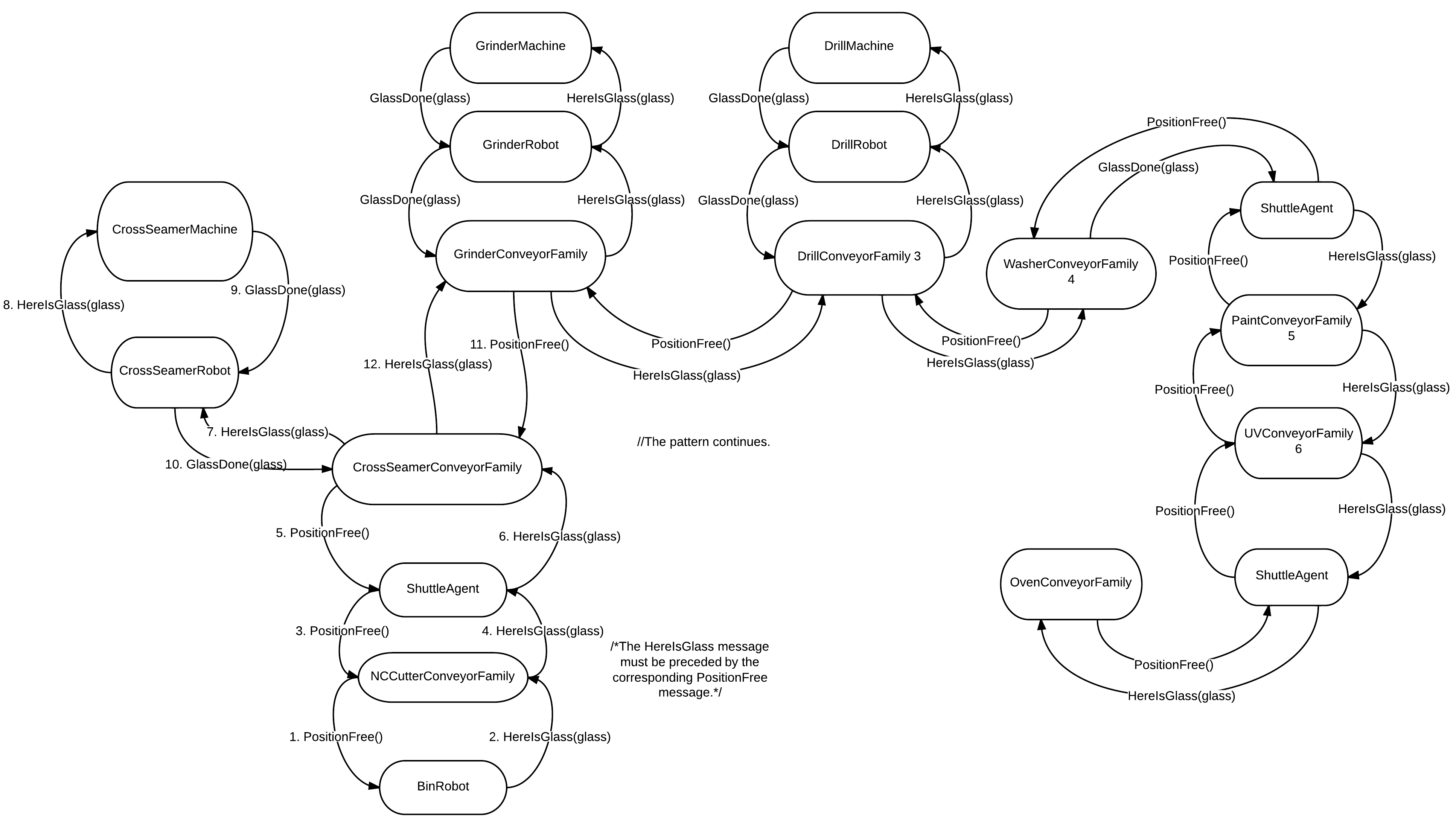
**\*****or t.e. = There Exists**

**\*s.t. = Such That**

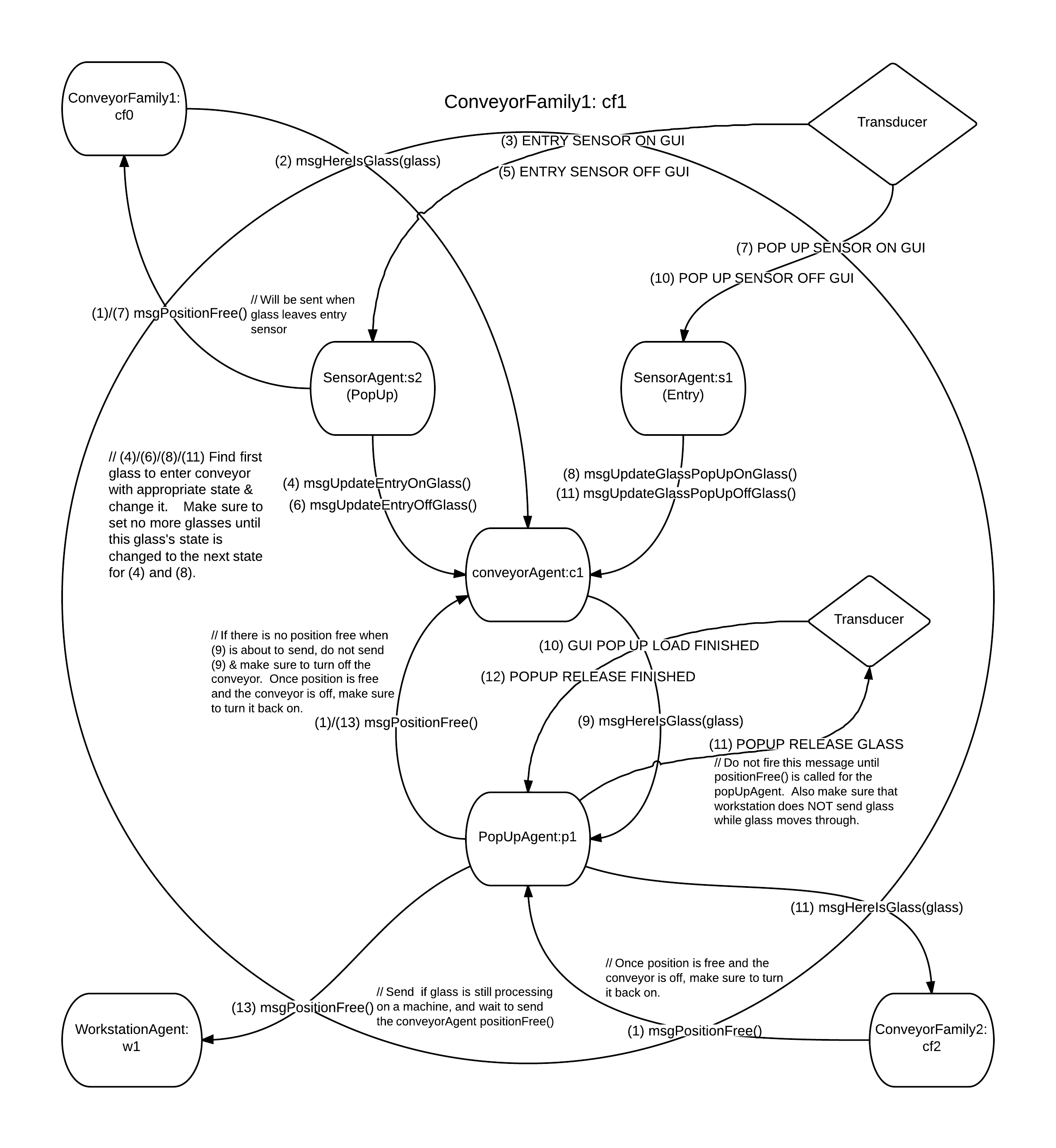
**\*****or f.a. = For All**

***Same* acronyms apply for the rest of the document**

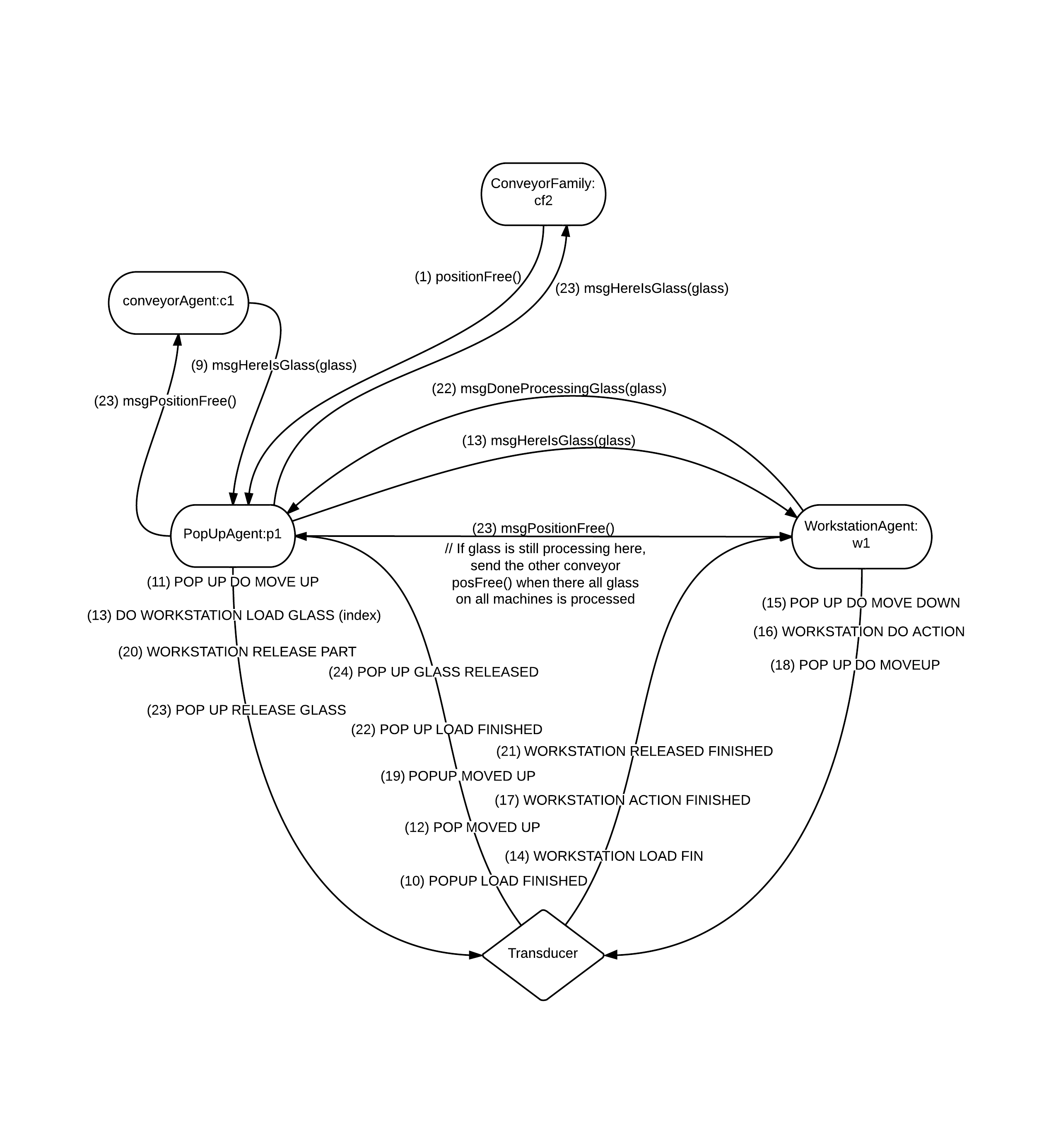
**Normative Interaction Diagram: Team**



**Normative Interaction Diagram: Team** includes the simple normative scenario under one hood. This scenario will be addressed in v1 and v2.

**Normative Interaction Diagram 1: Individual (Tim) – Version 2**

**Normative Interaction Diagram 1: Individual (Tim) Version 2** includes the normative scenario for the agent messaging system to be used for the conveyor family when a piece of glass does NOT need processing

**Normative Interaction Diagram 2: Individual (Tim) – Version 2**

**Normative Interaction Diagram: Individual (Tim) Version 2** includes the normative scenario for the agent messaging system to be used for the conveyor family. This design includes everything from the previous normative interaction diagram, but this included the glass processing transducer messaging and other things related to it.

**Agents & Other Classes:**

**Name:** Agent (Base Class)

**Description:** The Base Class that all agents inherit from.

**Data:**

Semaphore stateChange; // Semaphore to use to put the agent thread to sleep

AgentThread agentThread;

Transducer transducer; // Will hold a reference to the transducer

TracePanel tracePanel; // A link to the tracePanel on the animation GUI

**Methods:**

run() { // This method will be used for the agent’s thread

while (agent is active) {

if (pickAndExecuteAnAction)

then performAction()

else

then sleep() until stateChanged()

}

}

stateChanged(); // Release a permit from the semaphore

stopThread();

startThread();

pickAndExecuteAnAction(); // Scheduler

eventFired(); // Used for the transducer

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**Name:** Glass

**Description:** The class with values relating to a piece of glass – this is more like a struct.

**Data:**

int id; // the identifier for this piece of glass

Map<MachineType, Boolean> recipe; // Contains the recipe for this piece of glass

MachineType[] machineIDs = {MachineType.Cutter, MachineType.Cross\_Seamer, MachineType.Grinder, MachineType.Drill, MachineType.Washer, MachineType.Paint, MachineType.UV\_Lamp, MachineType.Oven} ; // Will hold references to anything that could be a part of the recipe

**Methods:**

N/A

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\*Note: For the next classes, there will be interfaces created that contain abstract implementations of the messaging methods. This will be used for unit testing and the conveyorFamily, specifically. This description will suffice for the rest of the interfaces relative to each agent/class.

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**Name:** Sensor (Interface)

// Theoretically, the sensor agent interface should not have anything within it

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**Name:** SensorAgent

**Description:** Will detect if a piece of glass has entered, exited, or on a popup for any given set of conveyors. Even though all of the sensor functionality currently melded into one agent, I may split this agent up into a base agent and three inheritance agents – EntrySensorAgent, ExitSensorAgent, and PopUpSensorAgent – during implementation

**Data:**

String type; // Will hold the type of sensor this is, and it may be of more than one type

ConveyorFamily cf; // Reference to the current conveyor family

int guiIndex; // Needed to communicate with the transducer

**Messages**:

// The following messages will be special to transducer events, and will be called after parsing arguments in the EventFired(args[]) function.

msgUpdateGlassEntrySensorEnter() {

cf.getConveyor().msgUpdateGlass(ConveyorEvent.onEntrySensor);

}

msgUpdateGlassEntrySensorExit() {

cf.getConveyor().msgUpdateGlass(ConveyorEvent.offEntrySensor);

}

msgUpdateGlassPopUpSensorEnter() {

cf.getConveyor().msgUpdateGlass(ConveyorEvent.onPopUpSensor);

}

msgUpdateGlassPopUpSensorExit() {

cf.getConveyor().msgUpdateGlass(ConveyorEvent.offPopUpSensor);

}

// All four for these agents will listen for sensor events and forward the appropriate sensor events to the conveyor agents

**Other Methods:**

N/A

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**Name:** Conveyor (Interface)

**Messages**:

msgGiveGlassToConveyor(Glass g);

msgGiveGlassToPopUp(Glass g);

msgPositionFree();

msgUpdateGlass(ConveyorEvent event);

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**Name:** ConveyorAgent

**Description:** Will hold the glass until it needs to go into the next conveyor for a different set of processes, or to leave the factory entirely.

**Data:**

Class MyGlass {

Glass glass;

enum conveyorState {beforeEntrySensor, onEntrySensor, beforePopUpSensor, onPopUpSensor};

}

List<MyGlass> glassSheets; // List to hold all of the glass sheets

boolean positionFreePopUp; // Will determine if a piece of glass should be passed to the next conveyor family. This will initially be set to true.

ConveyorFamily cf;

enum conveyorEvent {onEntrySensor, offEntrySensor, onPopUpSensor, offPopUpSensor, popUpFree}

List<conveyorEvent> events; // Used to hold all of the sensor events

int guiIndex; // Needed to communicate with the transducer

**Messages**:

msgGiveGlassToConveyor(Glass g) {

glassSheets.add(new MyGlass(g)); // conveyorState always initializes to beforeEntrySen.

stateChanged();

}

msgPositionFree() {

positionFreePopUp = true;

stateChanged();

}

msgUpdateGlass(ConveryorEvent event) { // This will receive all of the events forwarded from the sensor agents

events.add(event);

stateChanged();

}

**Scheduler:**

if (sensorEvents.empty()) return false:

SensorEvent e = events.remove(0);

if (e == onEntrySensor && $ g in glassSheets s.t. g.conveyorState == beforeEntrySensor) then

actSetGlassOnEntrySensor(g); return true;

if (e == offEntrySensor && $ g in glassSheets s.t. g.conveyorState == onEntrySensor) then

actSetGlassOffEntrySensor(g); return true;

if (e == onPopUpSensor && $ g in glassSheets s.t. g.conveyorState == beforePopUpSensor) then

actSetGlassOnPopUpSensor(g); return true;

if (e == popUpFree && $ g in glassSheets s.t. g.conveyorState == onPopUpSensor) then

actTurnOnConveyor(); return true;

if (e == offPopUpSensor && $ g in glassSheets s.t. g.conveyorState == onPopUpSensor) then

actSetGlassOffPopUpSensor(g); return true;

**Actions:**

actSetGlassOnEntrySensor(MyGlass g) {

g.conveyorState = onEntrySensor;

}

actSetGlassOffEntrySensor (MyGlass g) {

g.conveyorState = beforePopUpSensor;

cf.prevCF.msgPositionFree();

}

actSetGlassOnPopUpSensor (MyGlass g) {

g.conveyorState = onPopUpSensor;

if (!positionFreePopUp) then

turnOffConveyorGUI(); // Hack method, will actually be a transducer call in code

else

cf.getPopUp().msgGiveGlassToPopUp(g.glass);

}

actTurnOnConveyor () {

turnOnConveyorGUI(); // Hack method, will actually be a transducer call in code

}

actSetGlassOffPopUpSensor (MyGlass g) {

glassSheets.remove(g);

}

**Other Methods:**

N/A

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**Name:** PopUp (Interface)

**Messages**:

msgGiveGlassToPopUp(Glass g);

msgDoneProcessingGlass(Glass g);

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**Name:** PopUpAgent

**Description:** Will act as a mediator between the conveyor agent and the robot agents for getting glass to the processing machines, if necessary.

**Data:**

Class MyGlass {

Glass glass;

enum processState {unprocessed, processing, doneProcessing};

}

Class MachineCom { // Will hold a communication channel to a robot, allowing for the possibility to communicate to multiple robots at once

WorkstationAgent machine; // Robot reference

boolean inUse; // Is this channel currently occupied by a piece of glass

}

MachineType processType; // Will hold what the concurrent workstation agents can process for any given popUp – it is safe to assume that the workstations process the same thing

List<MyGlass> glassToBeProcessed; // This name will be abbreviated as gTBP in many functions to save on space and complexity

List< MachineCom > machineComs;

conveyorFamily cf; // Conveyor Family reference

boolean passNextCF;

int guiIndex; // Needed to communicate with the transducer

**Messages**:

msgGiveGlassToPopUp(Glass g) { // Get Glass from conveyor to PopUp

gTBP.add(new MyGlass(g, processState.unprocessed));

stateChanged();

}

msgGlassDone(Glass g, int machineIndex){

if ($ glass in gTBP s.t. g.id == glass.glass.id) then

glass.processState = doneProcessing;

else // this is a bug, it should never get here

machineComs(machineIndex).inUse = false;

stateChanged();

}

msgPositionFree() {

passNextCF = true;

}

**Scheduler:**

if ( g in gTBP s.t. g.processState == processState.unprocessed) then

if ( com in robotComs s.t. com.inUse == false && popUpDown == true) then

actPassGlassToMachine(g, com); return true;

if ( g in gTBP s.t. g.processState == processState.doneProcessing) then

actPassGlassToNextCF(g); return true;

return false;

**Actions:**

actPassGlassToMachine (MyGlass g, RobotCom com) {

if (g.glass.recipe.needsProcessing(com.processType) then

com.machine.msgProcessGlass(g.glass);

com.inUse = true;

g.processState = processing;

// Fire the appropriate transducer events

else

g.processState == processState.doneProcessing;

actPassGlassToNextCF(g);

// Remove statement isn’t needed – it is done within the actPassGlassToConveyor

// Fire the release glass transducer event

}

actPassGlassToNextCF(MyGlass g) {

if (passNextCF == true) then

cf.nextCF.msgHereIsGlass(g.glass);

gTBP.remove(g);

}

**Other Methods:**

N/A

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**Name:** ConveyorFamily (Interface)

**Messages**:

msgHereIsGlass(Glass g);

msgPositionFree();

msgDoneProcessingGlass(Glass g, int machineIndex);

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**Name:** ConveyorFamilyImp

**Description:** Will act as a wrapper class for a set of conveyors, sensors, and pop-ups. It will also contain a reference to robots and machines through its components

**Data:**

ConveyorFamily nextCF; // reference to the next ConveyorFamily – this could even be the final truck at the end of the line

ConveyorFamily prevCF; // reference to the previous conveyor family, will be NULL if it does not exist

ConveyorAgent conveyor;

List<SensorAgent> sensors; // Will hold all of the sensors of different types in one place – adds to the modularity of the system

PopUpAgent popUp;

**Messages**:

msgHereIsGlass(Glass g) {

conveyor.msgGiveGlassToConveyor (g);

}

msgPositionFree() {

conveyor.msgPositionFree();

}

msgDoneProcessingGlass(Glass g, int machineIndex) {

popUp.msgDoneProcessingGlass(g);

}

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