ID2209 HT23 Distributed Artificial Intelligence and Intelligent Agents

Homework 2 - Negotiation and communication (FIPA)

Group 25 - Dominika Drela, Eugen Lucchiari Hartz

November 21, 2023

This second assignment is a continuation of the festival simulation where we're introducing a sophisticated layer by incorporating the FIPA (Foundation for Intelligent Physical Agents) communication protocol. This entails the introduction of a new participant in the form of an auctioneer agent, specially designed to orchestrate auctions during the festival, showcasing and selling various items such as exclusive memorabilia and festival merchandise.

The chosen auction format is the Dutch auction, a dynamic mechanism where the auctioneer starts with a high price and systematically decreases it in successive rounds. The auction concludes either when a participant accepts the price or when the auction reaches a predefined minimum without any takers. A pivotal aspect of this development is the utilization of the FIPA protocol by festival attendees to interact with the auctioneer and engage in the negotiation process.

Agents

Guest

In Assignment 1, guest agents had the attributes hunger and thirst. However, for simplicity in this assignment we decided to remove these attributes so that the associated agents from the first assignment, information center, food and drink stores can be removed as well. Instead in this assignment the guest agents will await the initiation of auctions by the auctioneers. They will then employ FIPA behavior to guarantee that negotiations follow this specific protocol.

Auctioneers

During the festival, auctioneers specialize in selling autographed merchandise and similar products. They initiate the proceedings by listing the items slated for auction. If these items align with the guests' preferences, negotiations unfold among agents using the FIPA protocol. Employing a Dutch auction format, auctioneers possess the ability to incrementally lower prices and assess whether

to cancel the auction, considering factors such as a predetermined minimum price and the absence of interested buyers.

Implementation

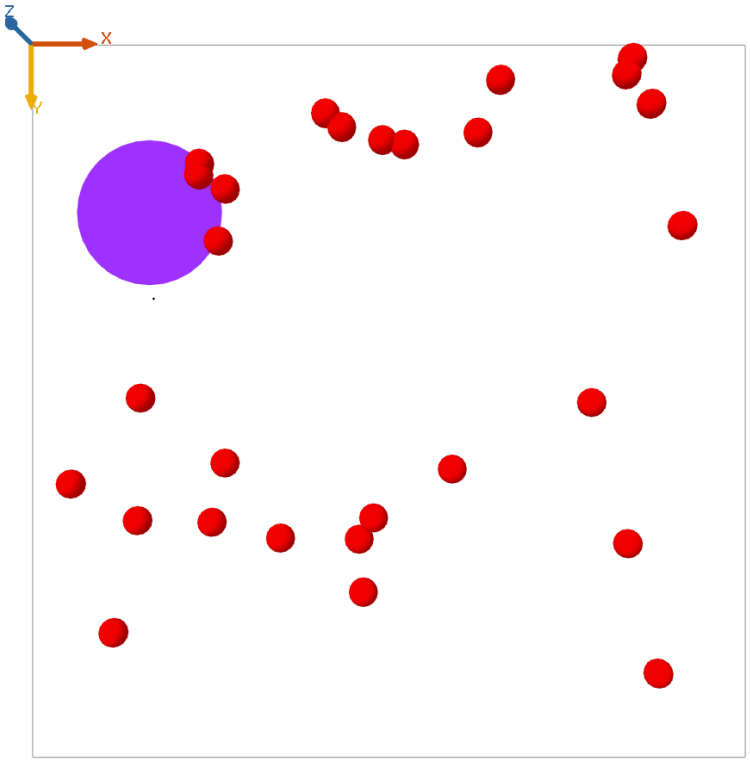
Incorporating the FIPA skill into the existing guest agents' movement behavior, we've equipped them with the ability to comprehend the FIPA protocol for negotiation purposes. This skill provides essential primitives and built-in variables facilitating agent communication through the FIPA interaction protocol. The Dutch auction process involves several reflexes:

- **inAuction reflex:** Manages the target auction, specifically the one that aligns with a particular guest's interests.
- **beIdle reflex:** Preserves the default behavior of guests during the festival, carried over from the previous assignment.
- **listenMessages reflex:** Monitors ongoing auctions and checks if the guest's preferred items are part of any current auction, ensuring non-empty FIPA interaction messages.
- **reply_messages reflex:** Enables auction participants to accept or reject the proposed prices from auctioneers.

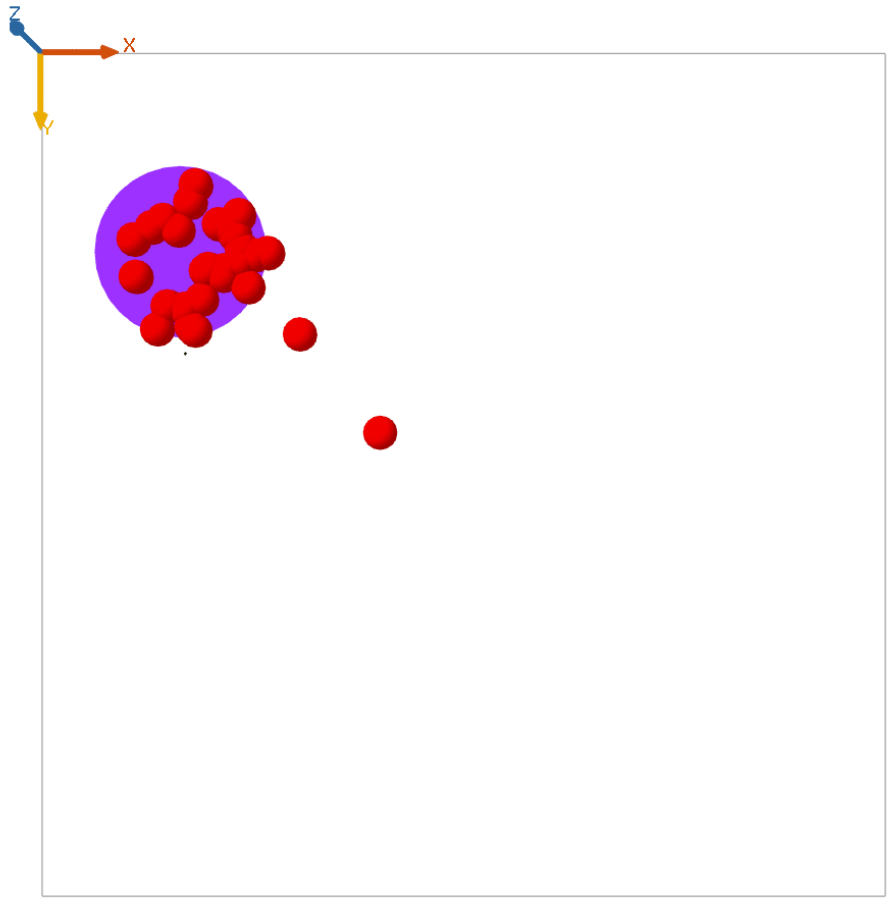
Moreover, new species have been introduced, such as AuctionerMaster, responsible for creating auctioneers with corresponding reflexes, and Auctioner, the agent executing auction-related actions. Auctioner species includes reflexes for initiating auctions, announcing items for sale, surveying guests in the vicinity, and handling acceptances or rejections of proposed prices in each auction round.

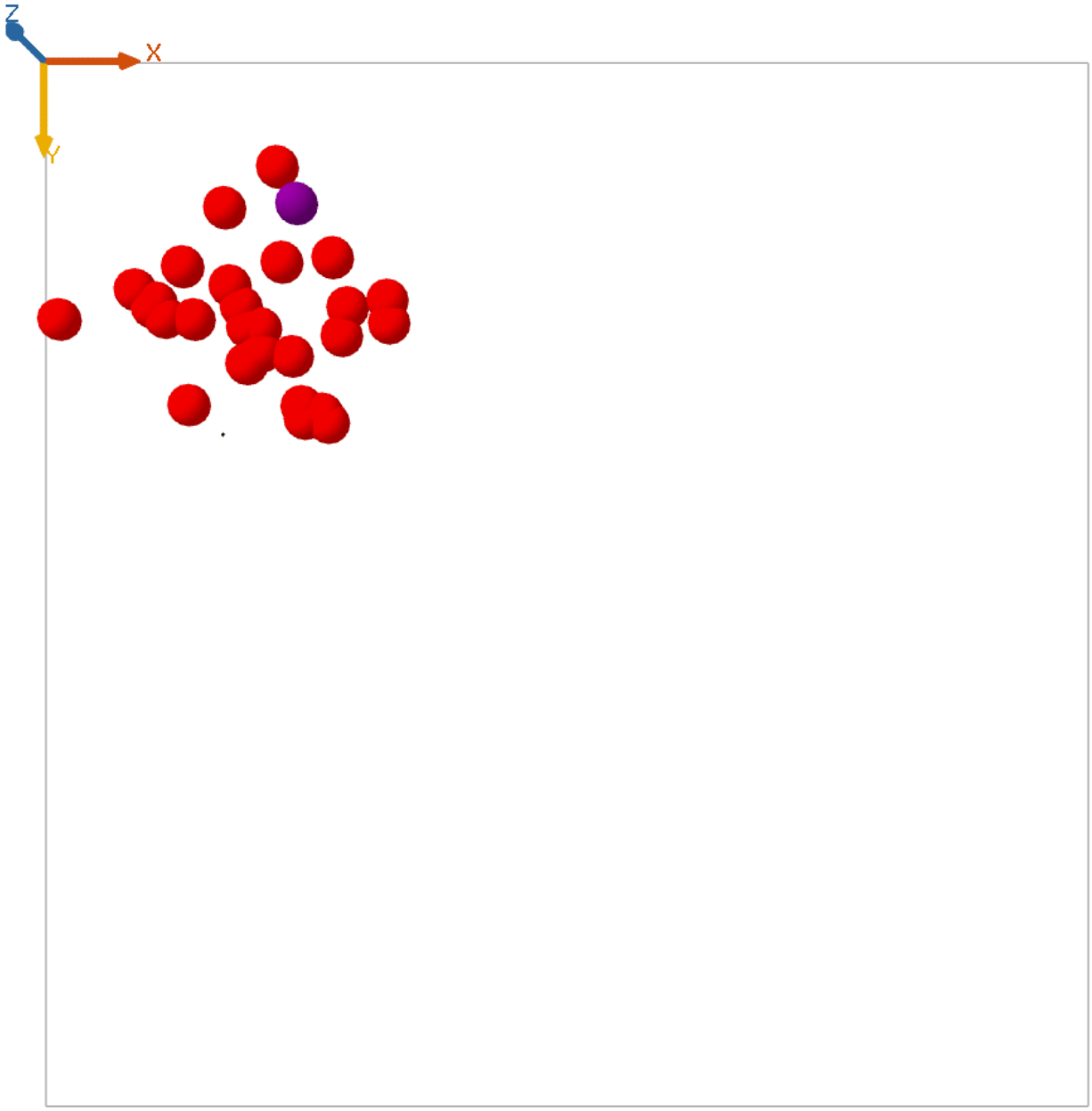
Result

As you can see in the following screenshots the simulation containing an auction where guest agents communicate using the FIPA protocol with the auctioneers runs as expected.



As you can see all the guest agents move to the auctioneer




Z
X
Y

In the log you can see that guests who joined the starting auction send offers. You can see how the amounts of the offers decrease at each stage.

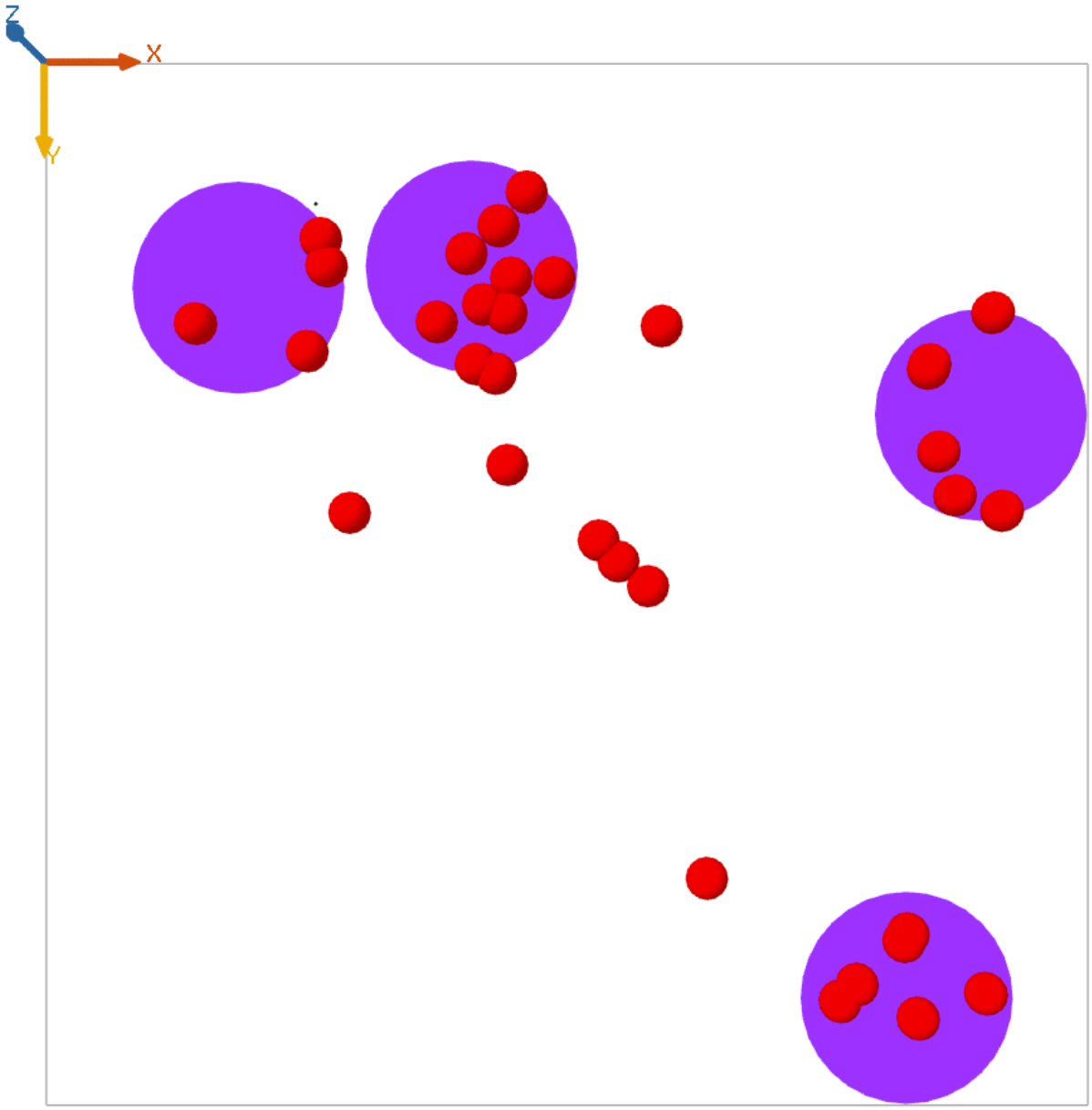
```
AuctionCreator0 creating auctions: Auctioner0 with Instruments
Auctioner0 starting Dutch soon
Guest0 joins Auctioner(0)'s auction for Instruments
Guest1 joins Auctioner(0)'s auction for Instruments
Guest2 joins Auctioner(0)'s auction for Instruments
Guest3 joins Auctioner(0)'s auction for Instruments
Guest4 joins Auctioner(0)'s auction for Instruments
Guest5 joins Auctioner(0)'s auction for Instruments
Guest6 joins Auctioner(0)'s auction for Instruments
Guest7 joins Auctioner(0)'s auction for Instruments
Guest8 joins Auctioner(0)'s auction for Instruments
Guest9 joins Auctioner(0)'s auction for Instruments
Guest10 joins Auctioner(0)'s auction for Instruments
Guest11 joins Auctioner(0)'s auction for Instruments
Guest12 joins Auctioner(0)'s auction for Instruments
Guest13 joins Auctioner(0)'s auction for Instruments
Guest14 joins Auctioner(0)'s auction for Instruments
Guest15 joins Auctioner(0)'s auction for Instruments
Guest16 joins Auctioner(0)'s auction for Instruments
Guest17 joins Auctioner(0)'s auction for Instruments
Guest18 joins Auctioner(0)'s auction for Instruments
Guest19 joins Auctioner(0)'s auction for Instruments
Guest20 joins Auctioner(0)'s auction for Instruments
Guest21 joins Auctioner(0)'s auction for Instruments
Guest22 joins Auctioner(0)'s auction for Instruments
Auctioner0 guestsAreAround
Auctioner0 sends the offer of 1518 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1507 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1496 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1491 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1483 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1473 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1460 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1446 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1431 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1426 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1416 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1411 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1403 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1395 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1382 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1375 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1367 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1355 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1348 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1338 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1333 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1322 krona to participants
```

Here you can see that the offer of guest14 gets accepted. Accordingly, guest14 won the auction and it is over. In the simulation the color of the guest agent who won turn from red to purple. Each guest gets notified about the termination of the auction.

```
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1312 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1297 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1290 krona to participants
Auctioner0 receives reject messages
Auctioner0 sends the offer of 1279 krona to participants
Auctioner0 receives accept messages
Auctioner0 got accepted by Guest(14): ['I, Guest14, accept your offer of 1279']
Guest0 knows the auction is over.
Guest1 knows the auction is over.
Guest2 knows the auction is over.
Guest3 knows the auction is over.
Guest4 knows the auction is over.
Guest5 knows the auction is over.
Guest6 knows the auction is over.
Guest7 knows the auction is over.
Guest8 knows the auction is over.
Guest9 knows the auction is over.
Guest10 knows the auction is over.
Guest11 knows the auction is over.
Guest12 knows the auction is over.
Guest13 knows the auction is over.
Guest14 won the auction for Instruments
Guest15 knows the auction is over.
Guest16 knows the auction is over.
Guest17 knows the auction is over.
Guest18 knows the auction is over.
Guest19 knows the auction is over.
Guest20 knows the auction is over.
Guest21 knows the auction is over.
Guest22 knows the auction is over.
Guest14 knows the auction is over.
```

Challenge 1

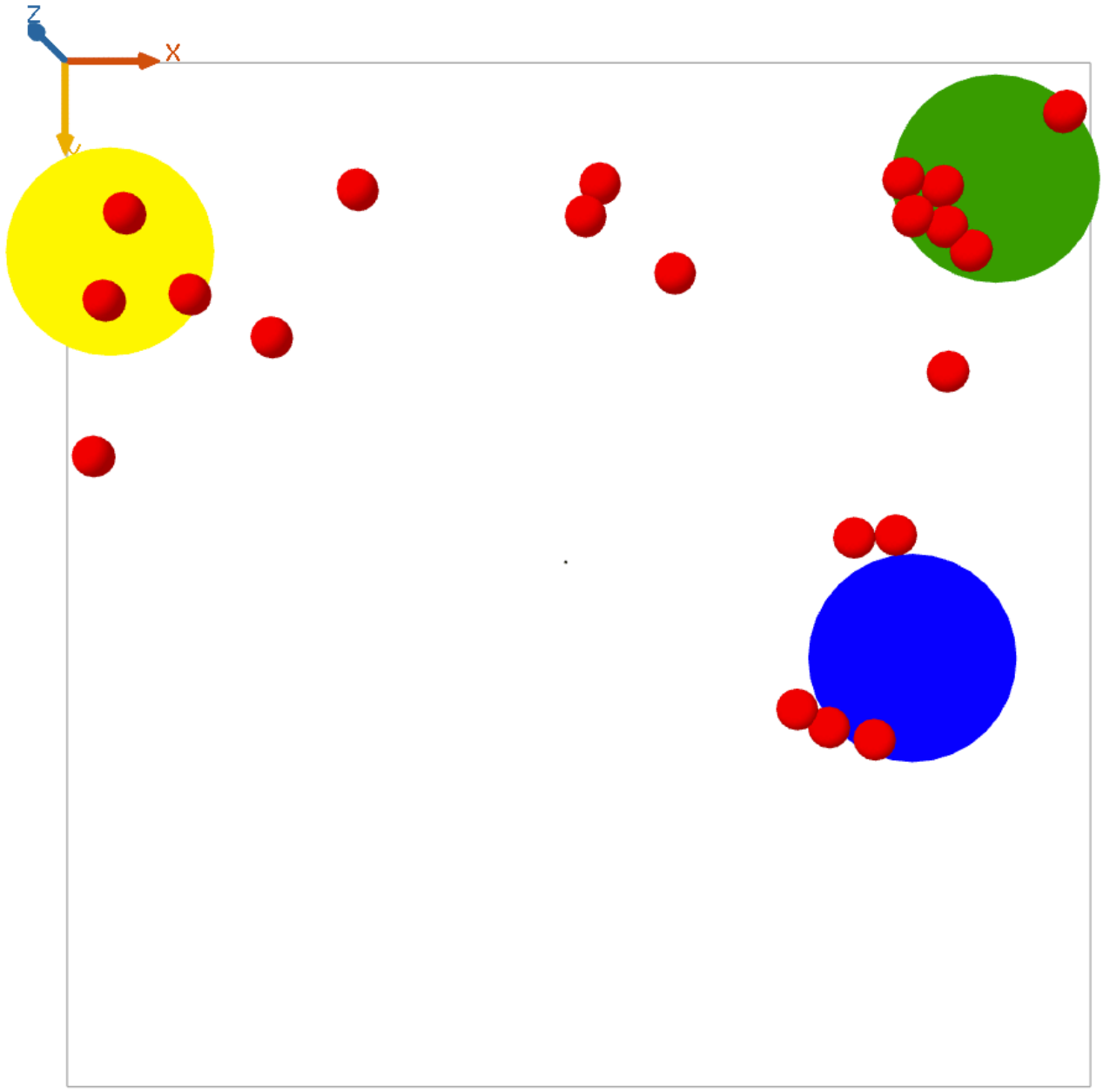
In this challenge several Dutch auctions should take place at the same time. In each action a different type of merchandise is sold. The following screenshots show the implemented challenge.




```
AuctionMaster0 creating auctions: Auctioneer0 with Instruments Auctioneer1 with signed shirts Auctioneer2 with memorabillia Auctioneer3 with posters and artwork
Auctioneer0 starting Dutch soon
Auctioneer1 starting Dutch soon
Auctioneer2 starting Dutch soon
Auctioneer3 starting Dutch soon
Guest5 joins Auctioneer(0)'s auction for Instruments
Guest8 joins Auctioneer(0)'s auction for Instruments
Guest9 joins Auctioneer(0)'s auction for Instruments
Guest20 joins Auctioneer(0)'s auction for Instruments
Guest25 joins Auctioneer(0)'s auction for Instruments
Guest27 joins Auctioneer(0)'s auction for Instruments
Guest32 joins Auctioneer(0)'s auction for Instruments
Guest3 joins Auctioneer(1)'s auction for signed shirts
Guest14 joins Auctioneer(1)'s auction for signed shirts
Guest19 joins Auctioneer(1)'s auction for signed shirts
Guest24 joins Auctioneer(1)'s auction for signed shirts
Guest28 joins Auctioneer(1)'s auction for signed shirts
Guest29 joins Auctioneer(1)'s auction for signed shirts
Guest0 joins Auctioneer(2)'s auction for memorabillia
Guest1 joins Auctioneer(2)'s auction for memorabillia
Guest6 joins Auctioneer(2)'s auction for memorabillia
Guest12 joins Auctioneer(2)'s auction for memorabillia
Guest13 joins Auctioneer(2)'s auction for memorabillia
Guest22 joins Auctioneer(2)'s auction for memorabillia
Guest23 joins Auctioneer(2)'s auction for memorabillia
Guest26 joins Auctioneer(2)'s auction for memorabillia
Guest2 joins Auctioneer(3)'s auction for posters and artwork
Guest4 joins Auctioneer(3)'s auction for posters and artwork
Guest7 joins Auctioneer(3)'s auction for posters and artwork
Guest10 joins Auctioneer(3)'s auction for posters and artwork
Guest11 joins Auctioneer(3)'s auction for posters and artwork
Guest15 joins Auctioneer(3)'s auction for posters and artwork
Guest16 joins Auctioneer(3)'s auction for posters and artwork
Guest17 joins Auctioneer(3)'s auction for posters and artwork
Guest18 joins Auctioneer(3)'s auction for posters and artwork
Guest21 joins Auctioneer(3)'s auction for posters and artwork
Guest30 joins Auctioneer(3)'s auction for posters and artwork
Guest31 joins Auctioneer(3)'s auction for posters and artwork
Auctioneer1 guestsAreAround
```

Challenge 2

In this challenge different types of auctions should take place. In our case the types of auctions we decided to implement are Dutch, English and Sealed. An English auction involves incrementing the price in each round, while sealed auctions consist of a single round of bidding before the results are disclosed. The implementation of these auction types includes additional configurations for the three auctions at the beginning, incorporating a list of the present auction types. Furthermore, reflexes and attributes are introduced for the "auctioneer" species to empower them in executing diverse auctions.
The following screenshots show the implemented challenge.




```
AuctionMaster0 creating auctions: Auctioneer0 with instruments Auctioneer1 with signed shirts Auctioneer2 with memorabillia
Auctioneer0 starting Dutch soon
Auctioneer1 starting English soon
Auctioneer2 starting Sealed soon
```

Dutch - decrementing prices

```
Auctioneer0 guestsAreAround
Auctioneer0 sends the offer of 1597 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1590 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1583 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1570 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1560 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1554 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1540 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1528 kronas to participants
Auctioneer0 receives reject messages
Auctioneer0 sends the offer of 1522 kronas to participants
Auctioneer0 receives reject messages
```

English - several rounds of bidding and incrementing prices in each round

```
Auctioneer1 guestsAreAround
Auctioneer Auctioneer1: current bid is: 0. Offer more or miss your chance!
Guest6 knows the auction is over.
Auctioneer1 got an offer from Guest(0) of 52 kronas.
Auctioneer1 got an offer from Guest(1) of 47 kronas.
Auctioneer1 got an offer from Guest(2) of 31 kronas.
Auctioneer1 got an offer from Guest(12) of 52 kronas.
Auctioneer1 got an offer from Guest(15) of 56 kronas.
Auctioneer1 got an offer from Guest(16) of 38 kronas.
Auctioneer Auctioneer1: current bid is: 56. Offer more or miss your chance!
Auctioneer1 got an offer from Guest(0) of 105 kronas.
Auctioneer1 got an offer from Guest(1) of 90 kronas.
Auctioneer1 got an offer from Guest(2) of 87 kronas.
Auctioneer1 got an offer from Guest(12) of 104 kronas.
Auctioneer1 got an offer from Guest(15) of 115 kronas.
Auctioneer1 got an offer from Guest(16) of 96 kronas.
Auctioneer Auctioneer1: current bid is: 115. Offer more or miss your chance!
Auctioneer1 got an offer from Guest(0) of 174 kronas.
Auctioneer1 got an offer from Guest(1) of 154 kronas.
Auctioneer1 got an offer from Guest(2) of 169 kronas.
Auctioneer1 got an offer from Guest(12) of 159 kronas.
Auctioneer1 got an offer from Guest(15) of 159 kronas.
Auctioneer1 got an offer from Guest(16) of 165 kronas.
Auctioneer Auctioneer1: current bid is: 174. Offer more or miss your chance!
Auctioneer1 got an offer from Guest(0) of 213 kronas.
Auctioneer1 got an offer from Guest(1) of 212 kronas.
Auctioneer1 got an offer from Guest(2) of 227 kronas.
Auctioneer1 got an offer from Guest(12) of 181 kronas.
Auctioneer1 got an offer from Guest(15) of 227 kronas.
```

Sealed - single round of bidding

```
Auctioneer2 guestsAreAround
Auctioneer2 time to offer your money!!
Auctioneer2 got an offer from Guest(4) of 1474 kronas.
Auctioneer2 got an offer from Guest(5) of 124 kronas.
Auctioneer2 got an offer from Guest(7) of 415 kronas.
Auctioneer2 got an offer from Guest(8) of 568 kronas.
Auctioneer2 got an offer from Guest(9) of 174 kronas.
Auctioneer2 got an offer from Guest(10) of 1269 kronas.
Auctioneer2 got an offer from Guest(11) of 1239 kronas.
Auctioneer2 got an offer from Guest(17) of 515 kronas.
Auctioneer2 got an offer from Guest(18) of 862 kronas.
Auctioneer2 got an offer from Guest(20) of 477 kronas.
Auctioneer2 bid ended. Sold to Guest(4) for: 1474
Guest4 won the auction for memorabillia
```

Conclusion

In this assignment, we expanded the festival simulation by introducing FIPA communication for guest agents, facilitating negotiations with auctioneers during Dutch auctions. The practical implementation of various auction types, including simultaneous Dutch auctions and the introduction of English and Sealed auctions, demonstrated the simulation's adaptability and complexity. The successful execution of these challenges highlighted the effective integration of communication protocols and diversified auction mechanisms into the festival scenario.