Delivery Schedule Simulation

Submitted to: Pratibha Kamal

Submitted by:
Ayush Karn(2K19/CO/454)

Delhi Technological University, Delhi-82

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my teacher **Ms. Pratibha Kamal** as well as our college(Delhi Technological University, Delhi)which gave me the golden opportunity to do this wonderful project on the topic "**DELIVERY SCHEDULE SIMULATION**" , which also helped me in doing a lot of Research and I came to know about so many new things I am really thankful to them.

Secondly, I would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

CERTIFICATE

This is to certify that Ayush Karn of A6 batch Computer Engineering Department (COE) having Roll No 2K19/CO/454 has successfully completed the project work entitled "**DELIVERY SCHDULE SYSTEM**" on Modeling and Simulation Course for Third Semester which is to be evaluated as the Mid Term Component.

Signature: Ayush Karn

Date :07-11-2020

ABSTRACT

In this project paper I have discussed the simulation of the delivery vehicle Mathematical and theoretical simulation is done along with some use of AnyLogic Software. I have also given the detailed description of a Conceptual model, Input and Output data. I have describe the structure of the simulation model and operation of its main blocks. Each delivery vehicle modelled as a separate object and used to construct the overall schedule for all delivery vehicles. This simulation model can be used as a decision support tool for an analyst.

DECLARATION

I here by declare that project report entitled "**DELIVERY SCHEDULE SYSTEM**" submitted by me (Ayush Karn 2K19/CO/454) to Delhi Technological University (DTU), Delhi is a record of original work done under the guidance of Ms. Pratibha Kamal for the course of Modeling and Simulation . All the codes and implementations are completely written and done by me.

Name: Ayush Karn

Roll No: 2K19/CO/454

Submitted to: Ms. Pratibha Kamal

GOALS

- To solve a class of problems aimed at assigning a set of scheduled trips to a set of delivery vehicles, in such a way that each trip is associated with one vehicle, and the cost function for all trips is minimized.

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- To understand the concept of Discrete Event Simulation Model

- To learn how to use a simulation software

- To learn how to make different models in simulation software

PROBLEM STATEMENT

- A delivery schedule defines a schedule of goods delivered by Truck from a Loading Docks to customers The model is aimed to simulate utilization of Truck in order to determine their usage and idle times.
- Truck belongs to different groups that have various parameters such as capacity and Loading time. Distribution routes for Truck are fixed. For each route, the following parameters are defined:
- 1) A sequence of customers (route points in case of multiple deliveries from same route)
- 2) Average time intervals for Truck moving between route points.
- 3) Loading and unloading average.

- Trucks are assigned to routes and schedules for routes are generated that minimize the total costs of a schedule by minimizing the idle time and maximizing used time.

CONCEPTS USED

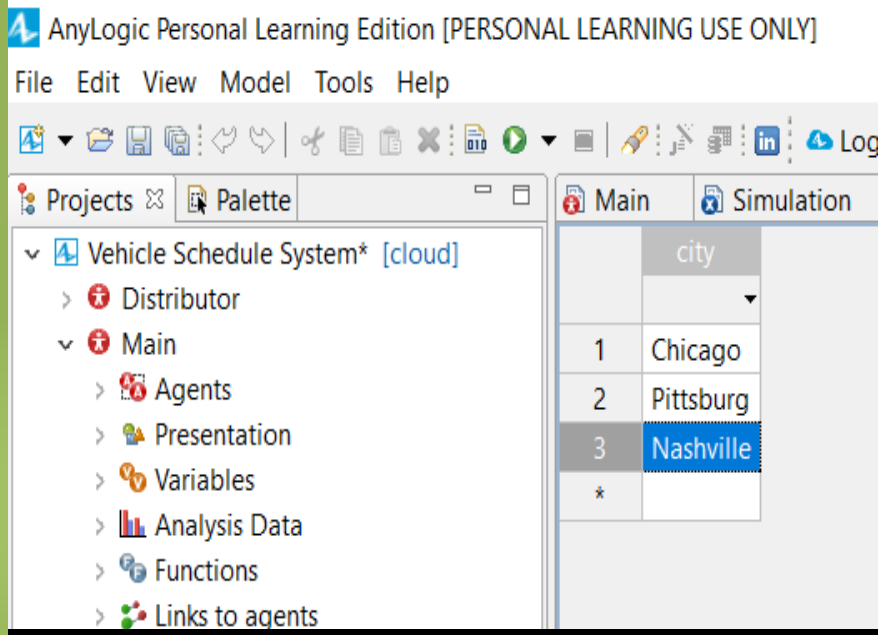
- Discrete Event Simulation(DES):Discrete event simulation (DES) is the process of codifying the behavior of a complex system as an ordered sequence of well-defined events. In this context, an event comprises a specific change in the system's state at a specific point in time.
- Multi Server Queuing System
- Generating Random Variable using Simulation Software (AnyLogic Software)
- Stochastic Process

COMPONENTS USED

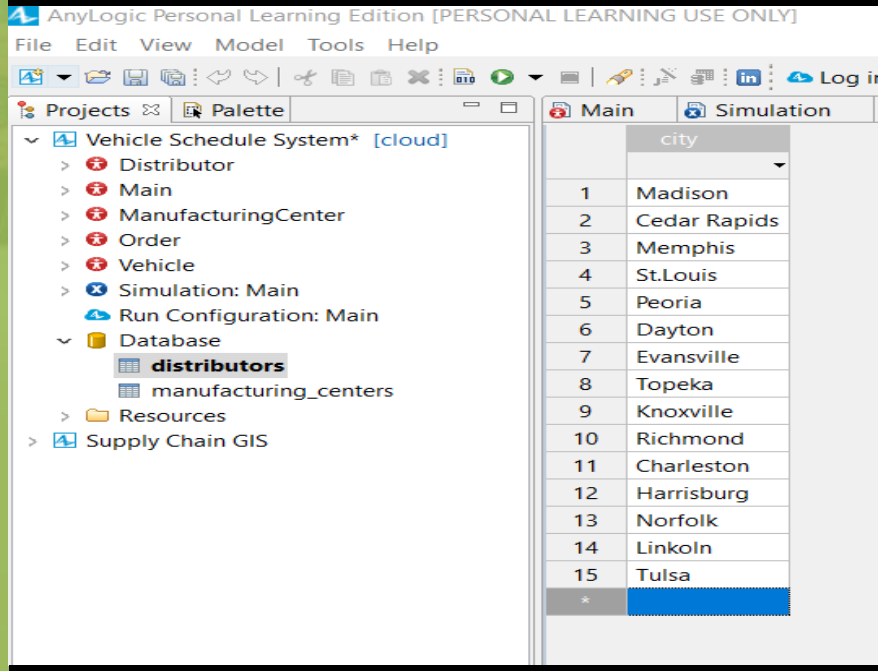
- Truck to deliver a product
- Number of trucks in a defined route
- Loading/Unloading Docks at Distribution Centre
- Customers
- Routes

INPUT DATA

- Goods
- Vehicles
- Customers
- Routes
- Distribution Centre
- Production Quantity (Random Variable)
- Orders (Random Variable)
- Total Truck= 09

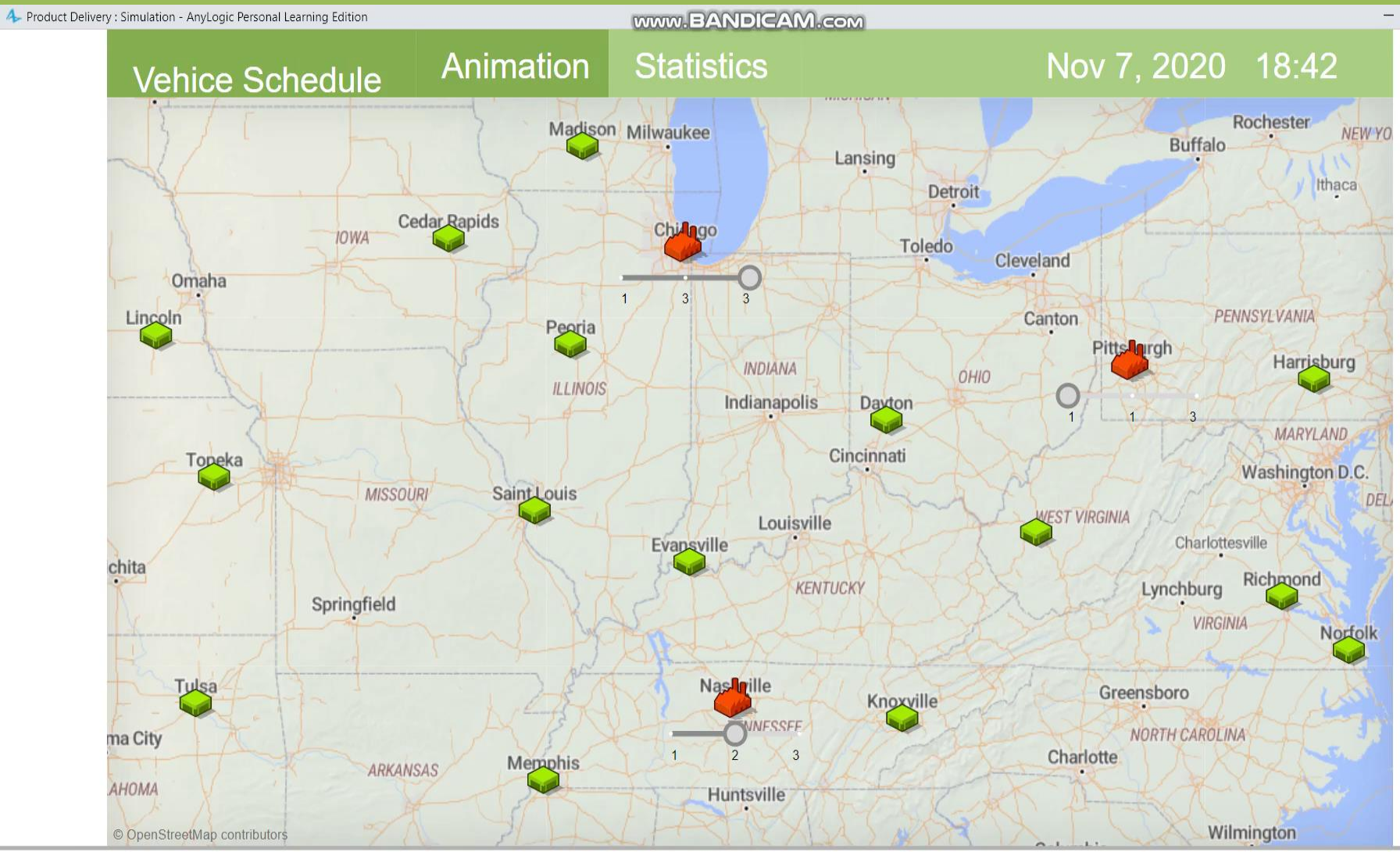


Manufacturing Centre

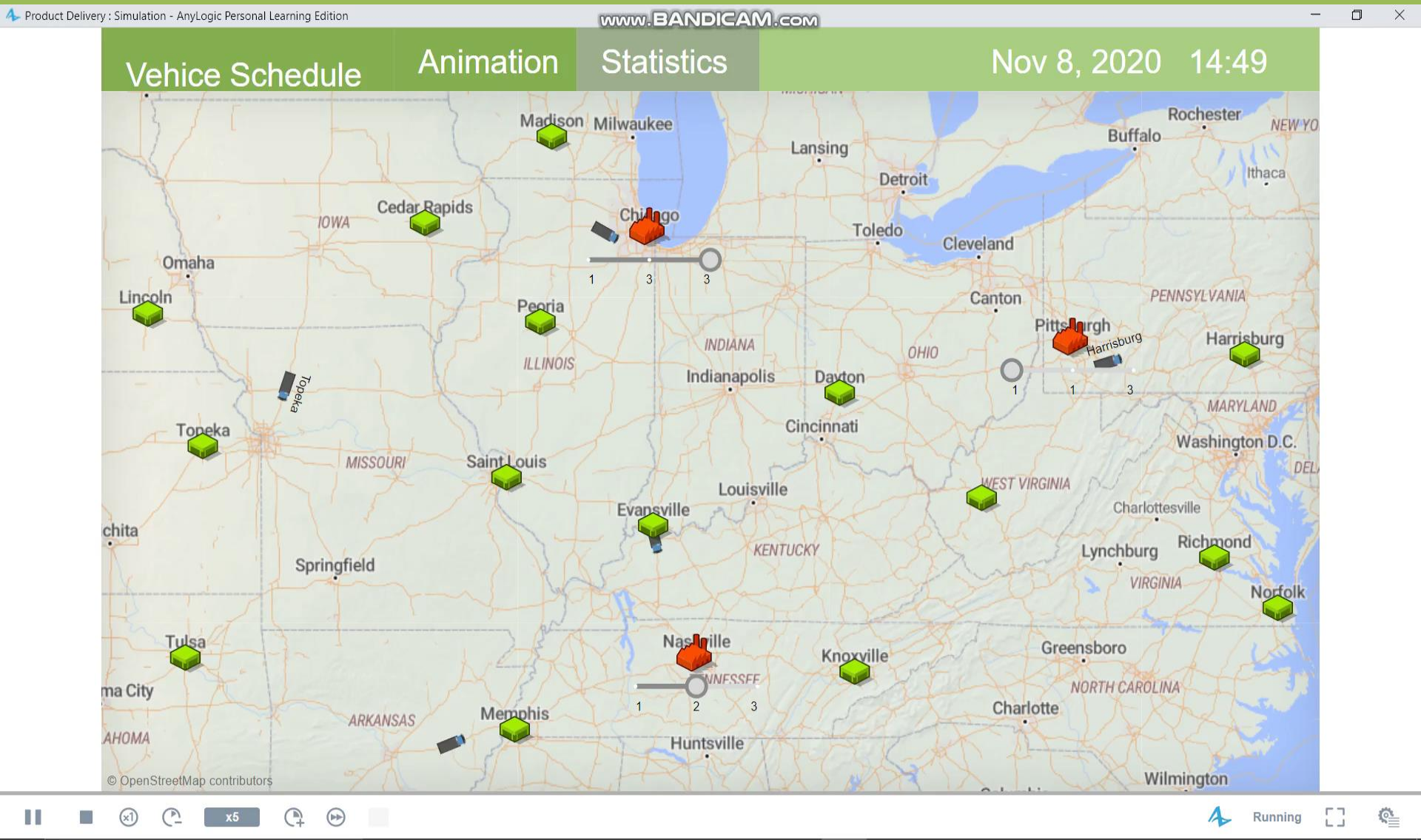


Distribution Centre

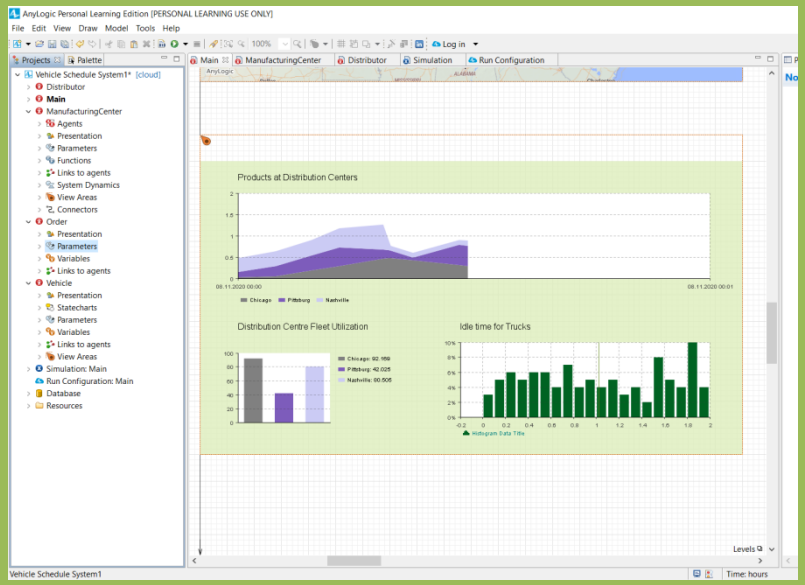
AnyLogic Simulation:

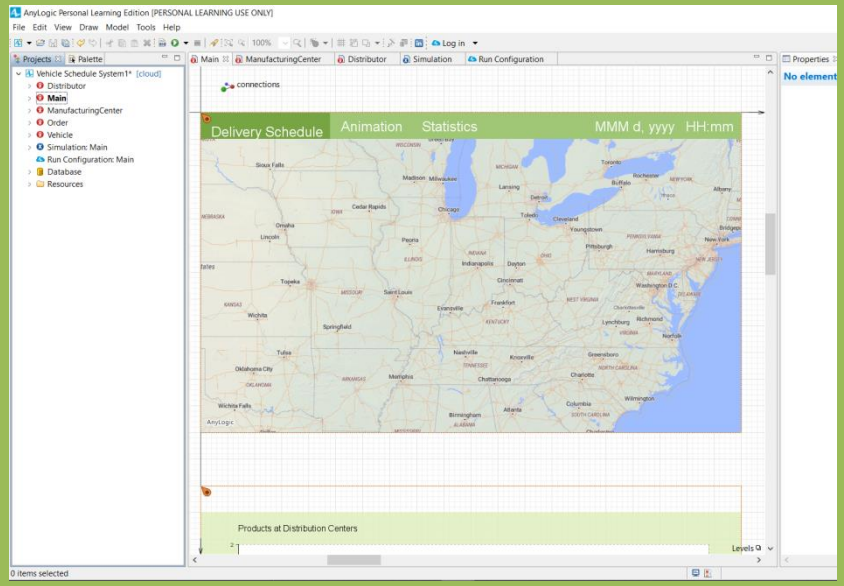


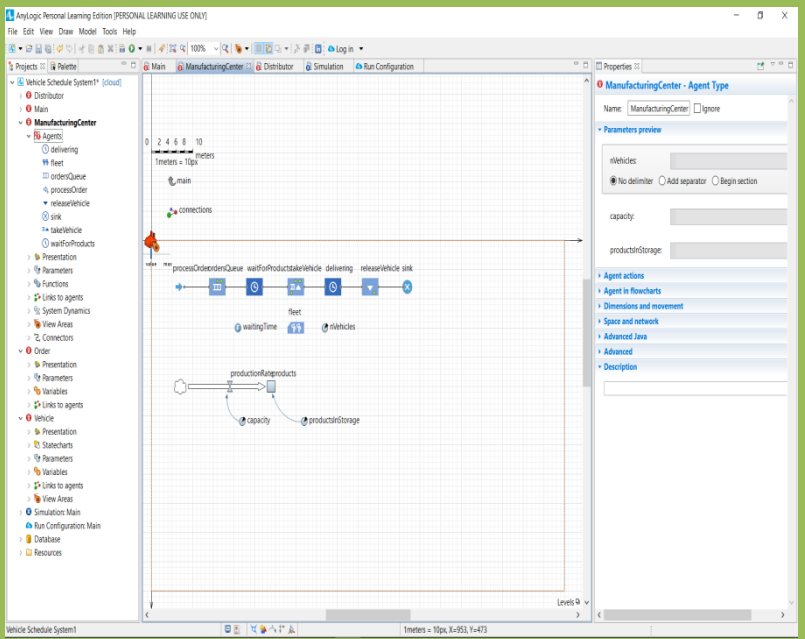
AnyLogic Simulation:

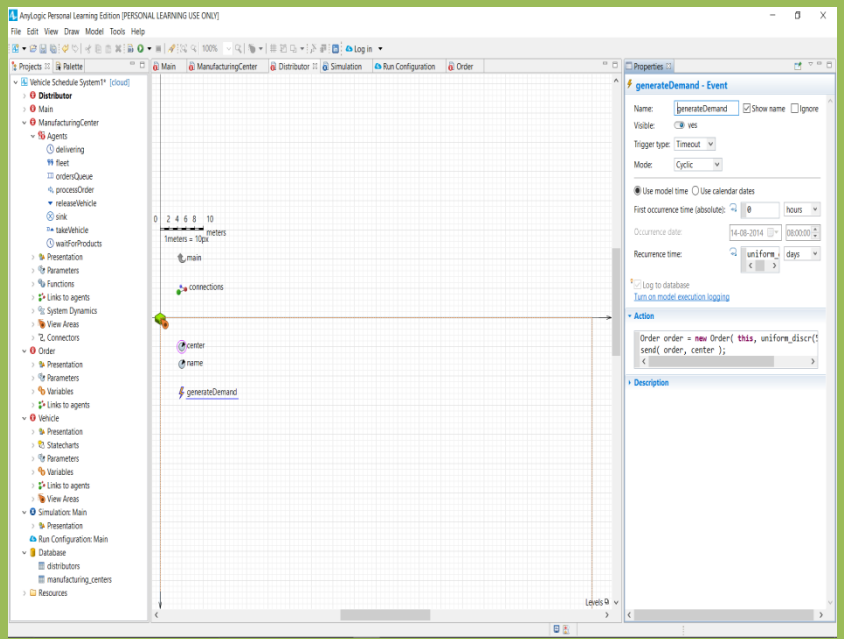


Some Screenshots of Work Done

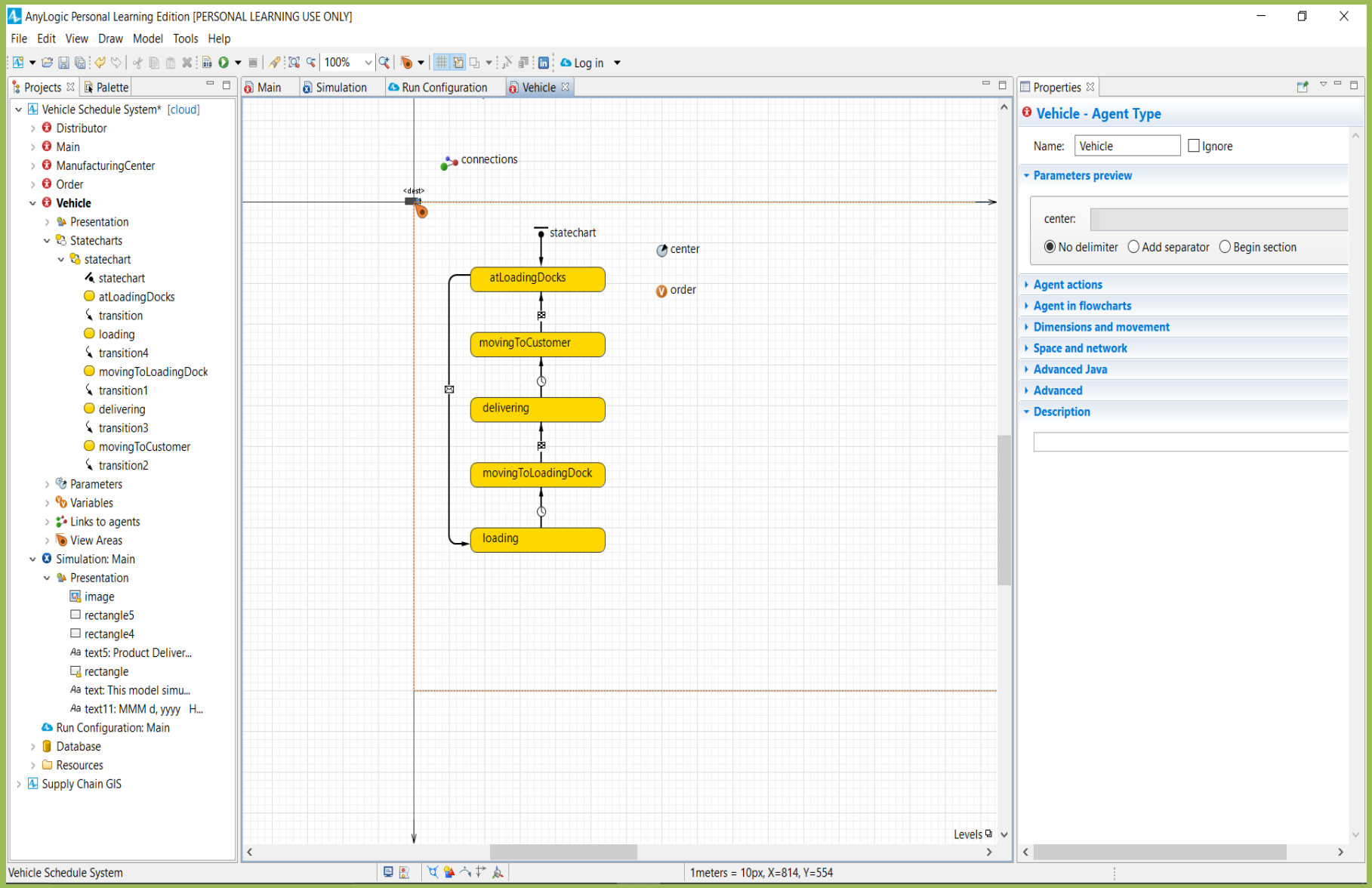




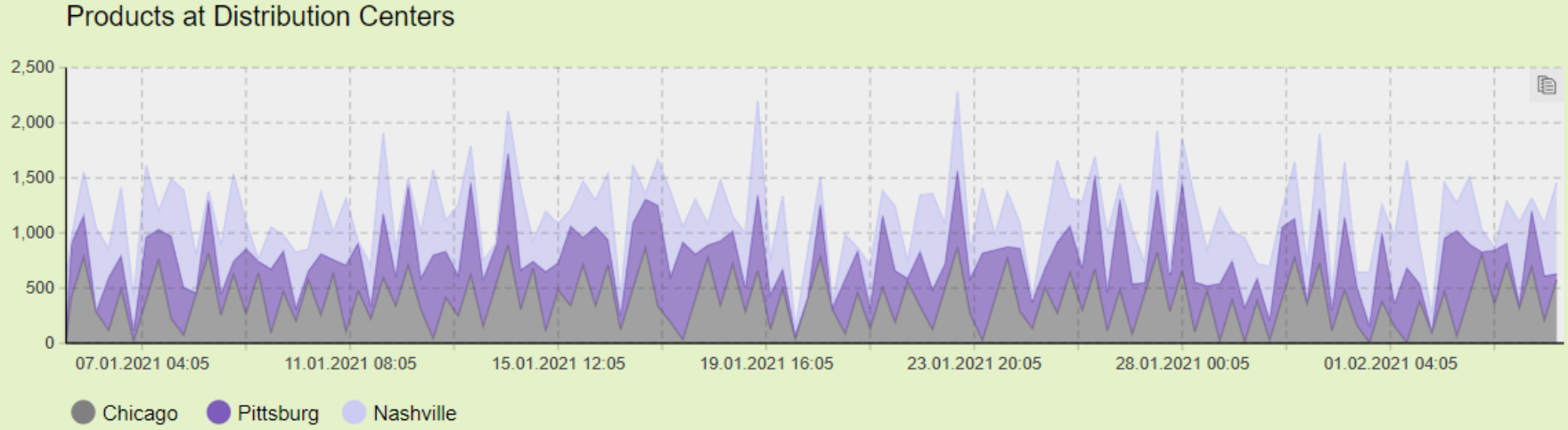


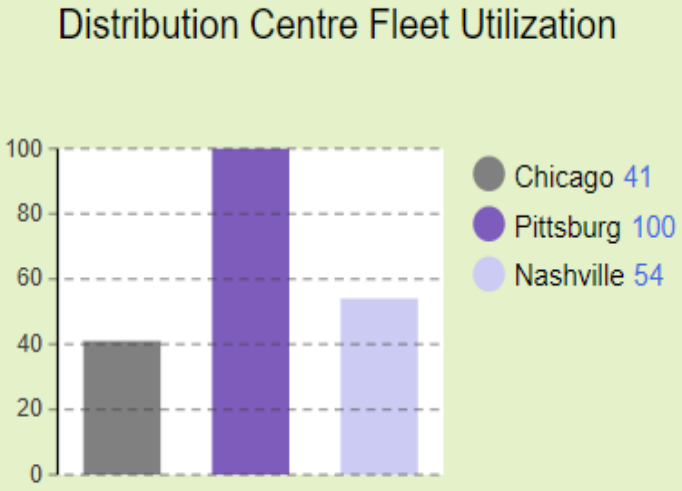


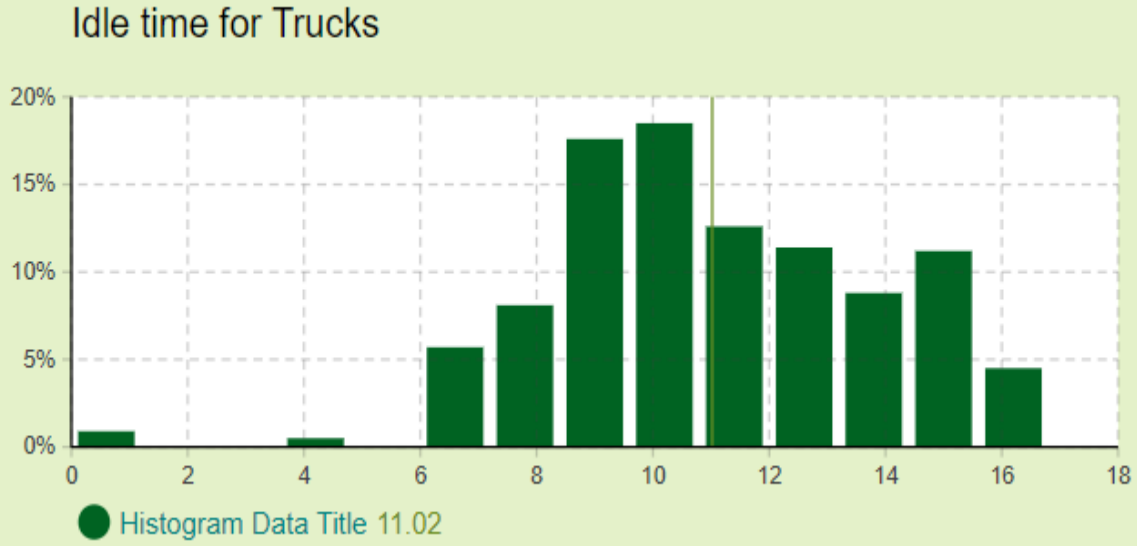
STATE CHART


AnyLogic Personal Learning Edition [PERSONAL LEARNING USE ONLY]
File Edit View Draw Model Tools Help
Projects
Palette
Vehicle Schedule System* [cloud]
Distributor
Main
ManufacturingCenter
Order
Vehicle
Presentation
Statecharts
statechart
statechart
atLoadingDocks
transition
loading
transition4
movingToLoadingDock
transition1
delivering
transition3
movingToCustomer
transition2
Parameters
Variables
Links to agents
View Areas
Simulation: Main
Presentation
image
rectangle5
rectangle4
text5: Product Deliver...
rectangle
text: This model simu...
text11: MMM d, yyyy H...
Run Configuration: Main
Database
Resources
Supply Chain GIS
Main
Simulation
Run Configuration
Vehicle
connections
<dest>
statechart
center
order
atLoadingDocks
movingToCustomer
delivering
movingToLoadingDock
loading
Levels
Properties
Vehicle - Agent Type
Name: Vehicle
Ignore
Parameters preview
center:
No delimiter
Add separator
Begin section
Agent actions
Agent in flowcharts
Dimensions and movement
Space and network
Advanced Java
Advanced
Description
Vehicle Schedule System
1meters = 10px, X=814, Y=554

OUTPUT DATA


Products at Distribution Centers
2,500
2,000
1,500
1,000
500
0
07.01.2021 04:05
11.01.2021 08:05
15.01.2021 12:05
19.01.2021 16:05
23.01.2021 20:05
28.01.2021 00:05
01.02.2021 04:05
Chicago
Pittsburg
Nashville


Distribution Centre Fleet Utilization
100
80
60
40
20
0
Chicago 41
Pittsburg 100
Nashville 54


Idle time for Trucks
20%
15%
10%
5%
0%
0
2
4
6
8
10
12
14
16
18
Histogram Data Title 11.02

ADVANTAGES

- Conditions can be varied and outcomes investigated.
- Critical situations can be investigated without risk.
- It is cost effective.
- Simulations can be sped up so behavior can be studied easily over a long period of time.
- Simulations can be slowed down to study behavior more closely.
- It can avoid danger and loss of life.

CONCLUSION

AnyLogic-based simulation model described in the paper could be used as a decision support tool for advanced analysis of the vehicle schedule with time windows generated by a standard scheduling software. This model provides “what if” analysis for further improvement of a vehicle schedule.

As all vehicles are simulated separately, simulation model is very flexible in terms of unique parameter definition for each vehicle. Moreover, this model can be applied for simulation-based optimization of vehicle scheduling problem with time windows. In this case the model would provide fast estimation of proposed optimal variants of schedule.

References:

-AnyLogic Software https://www.anylogic.com/

-AnyLogic Simulation Model building Guides by https://www.anylogic.com/

-Modeling and Simulation by Averill M Law.

-AnyLogic Online course on Coursera.