Gas Station Model

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Abstract

Gas station is a common but very important place, in which we not only can refuelling, but also can buy snacks. With the development of society, there are more and more services in gas station, which has brought us many conveniences for our life and work. In the service of gas station, it mainly divides into auto service and artificial service, e.g. you can use card payment or cash payment for refuelling. This paper focuses on the working principle of gas station and research about the dependencies between the objects of vehicles, pumpers, shop etc. And then through developing an Empirical Modelling model to simulate gas station situation so as to help the people who can use my model to understand the gas station working principle better.

1 Introduction

In our daily life, we can easily see the gas station in the road or next to the exit of supermarkets. For the drivers who are engaging in the transportation industry, it has become the second home for them. The gas stations not only help the drivers to solve the problem of fuel shortage, but also supply a short-term rest area for the car driver. I believe we all know the significance of gas station which does not need too much explanation. But for the working principle, except the drivers, a lot of passers may not know it. This paper focuses on the working principle of gas station and research about the dependencies between the objects of vehicles, pumpers, and shop etc. For example, we know that gas stations usually have two kinds of payment methods: by cash or card payment, we can through changing the status of gas station shop to observe the dependency relationship in the other objects.

In addition, I will develop an Empirical Modelling model to simulate gas station situation so as to help the people who can use my model to understand the gas station working principle better. On the other hand, through the process of developing this model; I not only can learn more about the Empirical Modelling, but also improve my development ability.

2 Gas station and Empirical Modelling

2.1 EM Introduction

Empirical Modelling ("EM") is a body of principles and tools concerned with computing activity that is based on observation and experiment [1],Nowadays, there have been some software tools for the EM development, such as tkeden, developed by Edward Yung. This tool mainly uses Eden language to handle logic relationship. The Scout can be used for handling the screen layout and the Donald can be used for drawing 2D line. As the version updating, more notations are added, such as CADNO; EDDI; SASAMI; AOP etc, so as to provide more favourable conditions for building EM model. EM mainly includes three aspects: The observable object, the dependencies between the observable object and agents.

2.2 Gas Station Viewpoint

About the gas station observation, different groups have different opinions. For the car drivers, they are more concerned about waiting time for pumping and how to choose the right wait queue to finish pumping at the fastest time and then leave the gas station. However, for gas station managers, they are more concerned about the gas station facilities and the distribution of service personnel; while for the gas station servers, they are more concerned about the shop services. This article mainly through the perspective of car driver to analyze dependencies among the vehicles, shop, pumpers etc during the car entering the gas station, waiting in the shortest queue, pumping, making a payment for the pumping until leaving gas station.

2.3 Some Models for Study

This section mainly introduces some reference models which are used to help solve some specific problems when I am building gas station model. These models mainly include: Nimleeke model, Road system model, railway model, water supply model. The following are two example models to introduction.

2.3.1 Nimleeke Model

This model mainly simulates a simple game, providing some buttons for user operation, Then through the change of button, we can clearly observed the

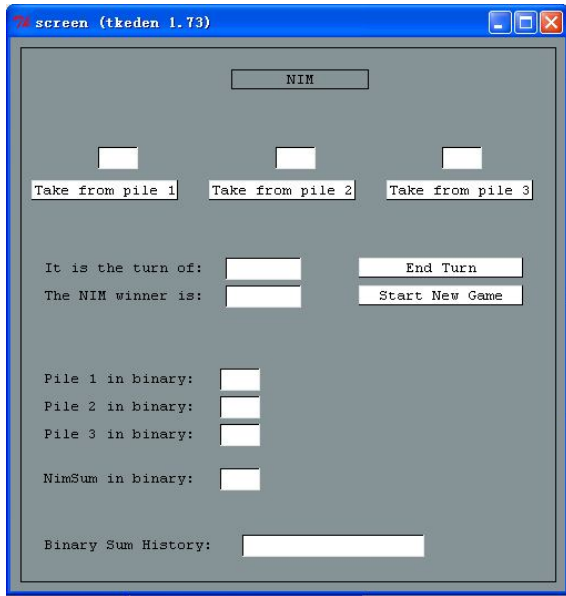dependency between some observable objects in this model.

Figure 1: The Nimleeke Model figure

Through this basics model study; we can know some basic notations such as the using method of Donald, Scout and Eden, and how to build the simple EM model.

2.3.1 Road System Model
This model allows the user to lay out a city's transport routes according to their own idea, and the vehicles can move freely in the road. Users can add some traffic lights to control traffic to solve traffic jam problems
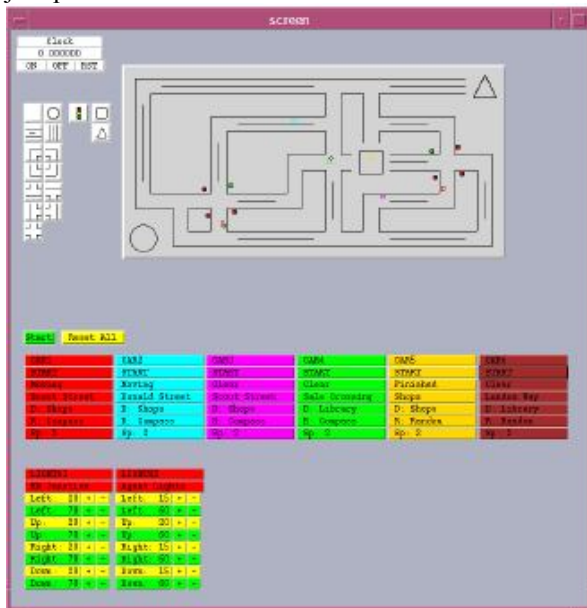

Figure 2: The road system model figure

The road system model is a complex model, it is using a good algorithm analysis, and users can create roads based on their own ideas. In this model, I know the benefits of interaction with users.

3. EM Modelling

3.1 Model Description
The main purpose for this model is to consider the work principle and observe the dependencies among objects in the gas station. Through the establishment of the gas station model, we not only can make ourselves deepen the understanding of the internal relationship between the gas station, but also help others to better understand the dependencies between the observable objects during pumping process. In the gas station model, mainly through control the pumper state to observe the dependencies among objects. In this model, each pumper is independent; pumper's state will affect many of the objects: the shop's status, vehicles' action; such as pumper state is open, then the car waiting in the queue can move to pumping. When has the cash payment car in pumping, the state of shop could not be closed and so on.

3.2 Model Design
3.2.1 Observable

The observable is the entity in the model. The mainly observables in the gas station model include:

Car	The vehicles which want to refuelling
Shop	The place for the driver to make a payment
Pumper	The tool to pumping
Driver	The person who is driving the car
Queue	The place waiting to pumping or make a payment

Figure 3: The objects figure

3.2.2 Dependency

The dependency is the relationship among the observables. It means that if the value of one observable is changed, the other observables which connect with will be change immediately. The mainly dependencies in the gas station include:

- Shop – Pumper, if the shop is closed, the pumpers which is cash payment will be closed. When the shop is opening, the pumper will can be open. But if the cash payment type of pumper is using, the shop could not be closed.
- Car – Pumper, if the pumper is idle, the car which in the waiting queue can move to pump-

ing, and the pumper state will be changed, this pumper can be used until the car leaving

- Car – Car, when the first one moves to pump, the second one will move to the first position, the third one will move to the second position etc.
- Driver – Driver, when the first one has paid, the second will move to pay, and the third one will move to the second position etc

3.2.3 Gas Station process
The main process in the gas station is:

For the cash payment type: the car moves to the gas station and then waits for pumping, when the pumper is free, and the car which is the first one in the queue will move to refuel, and then the driver will go to make a payment in the shop reception, finally the car leaves the gas station.

For the card payment type: the car moves to the gas station, and then waits in the card payment queue, when the pumper is free, and then the car moves to the pumper, makes a payment before pumping, after pumping, it will leave the gas station

4. Implementation

4.1 The EM Tool
The main development software for building the gas station is tkeden, this tool is flexible and simple to use.

4.2 Gas Station Model Implementation
The implement of this model mainly can divide in to two parts: the first one is using Donald to drawn the basic interface and then using the Scout for layout the components in the interface, displaying in the screen; the other part is the logical implementation, this part is mainly using Eden to handling the actions.

In this model, the rectangle represents the vehicle, and the two lines represent the queue, the vehicles move between the lines, there are three vehicles waiting queue, and one queue in the shop. The rectangle with the labels represents the pumpers, the green colour represent this pumper is free, the vehicles can pump in this pumper, the red colour represent this pumper is closed. We can use the button to control the state of pumper and the state will be shown in the information form. The payment process button is used to handle the payment actions in the shop.
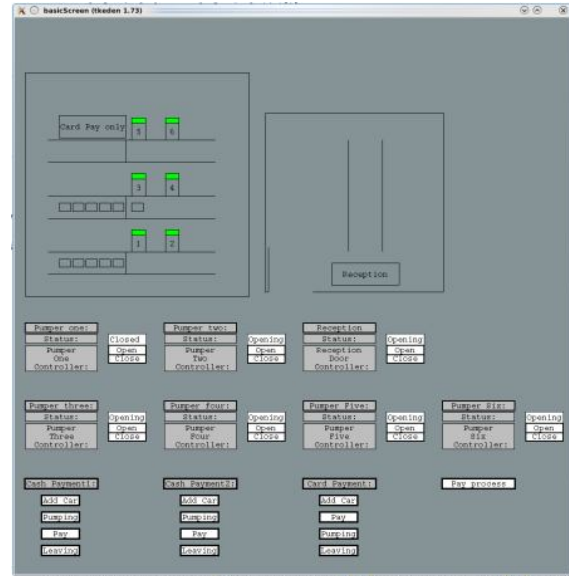

Figure 4: The gas station model figure

The above figure is showing the interface of the gas station model. The whole refuelling process is completed through the mouse click button step by step. The user can click the buttons to control the actions, in order to help the person who are using my model to understand the gas station working principle better

We can click the Add Car button to add a new car to the waiting queue, this car chooses to wait in queue one or two based on the number of cars in the waiting queue, if the queue one number is smaller, the new car will wait in the queue one, and otherwise, it will display in the queue tow. And then click the pumping button the car which in the first position will move to pump, and the pumper will changed the state, the colour will be changed; the following step is payment, we can click the pay button to finish payment and then a driver will be added in the shop waiting queue. The car will leave until the driver has paid.

The car which is used the card payment type pumping process is similarly.

5 Testing

The integration testing is the main testing method in the develop process. It is based on a system specification to check whether the integrated components can run normally or not.
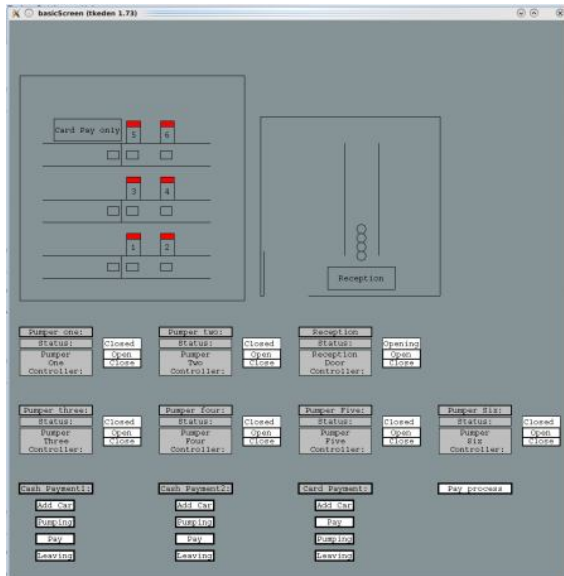
Figure 5: The model test figure

After testing, the basic features what was designed have been implemented, but there are many places can be improved

6. Conclusion and Future work

Empirical modelling is modelling based on empirical observations. Through the understanding of artefacts which will be used for building model, observe the object and the dependencies among the object to build model. This paper focuses on the gas station working process, using the EM principle to observe the objects in the gas station and the dependences of them. And then, I have used the Eden to building a gas station model. The basic features have been implementation, but still have many place can be improved.

For the further developments of the gas station model, we can landscape the user interface; add auto pumping function, the vehicles can pump automatically; adding pumpers function, and the users can control the position of the pumper. Furthermore, we can add some more variable in the model.

Acknowledgements

References

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[2] Yung. Y.W., The EDEN Handbook, University of Warwick, 1988