THE USE OF SIMULATION IN BUSINESS AREA

The aim of the article is to present the possible use of simulation in business. The suggested methodology uses the partial differential equations of second order. The built up model is described, its inputs and outputs are explained and interpretation of its results are mentioned. The case study is presented on simulation in business. The conclusion covers the advantages and disadvantages of simulation. The simulation serves as a support of decision making processes to entrepreneurs.

Simulation, model, competitive environment, business

Introduction

The two dimensional partial differential equation of second order is used for the simulation in business. The article presents the built up model, equation necessary for calculation, explains the used variables and their interpretation in the business. The use of simulation is described generally and case study is focussed on business.

Theory

Two dimensional partial differential equations of second order is used for the simulation in the form

$$\frac{\partial U}{\partial t} = C_x \frac{\partial^2 U}{\partial x^2} + C_y \frac{\partial^2 U}{\partial y^2}.$$

The used differential equation [Dostál 2008] is in the form

$$U_{t+1,i,j} = U_{t,i,j} + C\left[Cx_{ij}\left(U_{t,i,j-1} - U_{t,i,j} + U_{t,i,j+1}\right) + Cy_{ij}\left(U_{t,i+1,j} - 2U_{t,i,j} + U_{t,i-1,j}\right)\right],$$

where

$$C = \frac{\nabla t}{(\nabla x)^2}.$$

Build-up simulation model

The model was build-up for the simulation in business. The input is a simulation constant, the constants matrixes (n x m) and (n x m) present the rate of "resistance" of competition environment in the direction of coordinates x, y of each cell and matrix $U_{0,i,j}$(n x m) represents the initial conditions of utilization in time $T_0 = 0$. The value of T_{end} is the end time of simulated process. The meaning of used variable in the competitive environment simulations is as follows: The values of "cells" represent the utilization of searched objects with index of time t and coordinates i, j. The utilization is in the range from 0% to 100%, where 0% means the zero utilization and 100% means the maximum utilization. The various conditions and situations and their changes in time create the dynamic competitive environment.

Case study

The case study presents the situation of 10 existing restaurants in the territory of part of town Brno in Czech Republic. The simulation is used for evaluation of customer influx during the winter season. It helps to make the decision making process solving the problem of number of employs during the winter season. The restaurants for judgmental forecasting are marked by number from 1 to 10. See Figure 1. The initial state of utilisations *U* is represented numerically at Figure 2 and graphically at Figure 3.
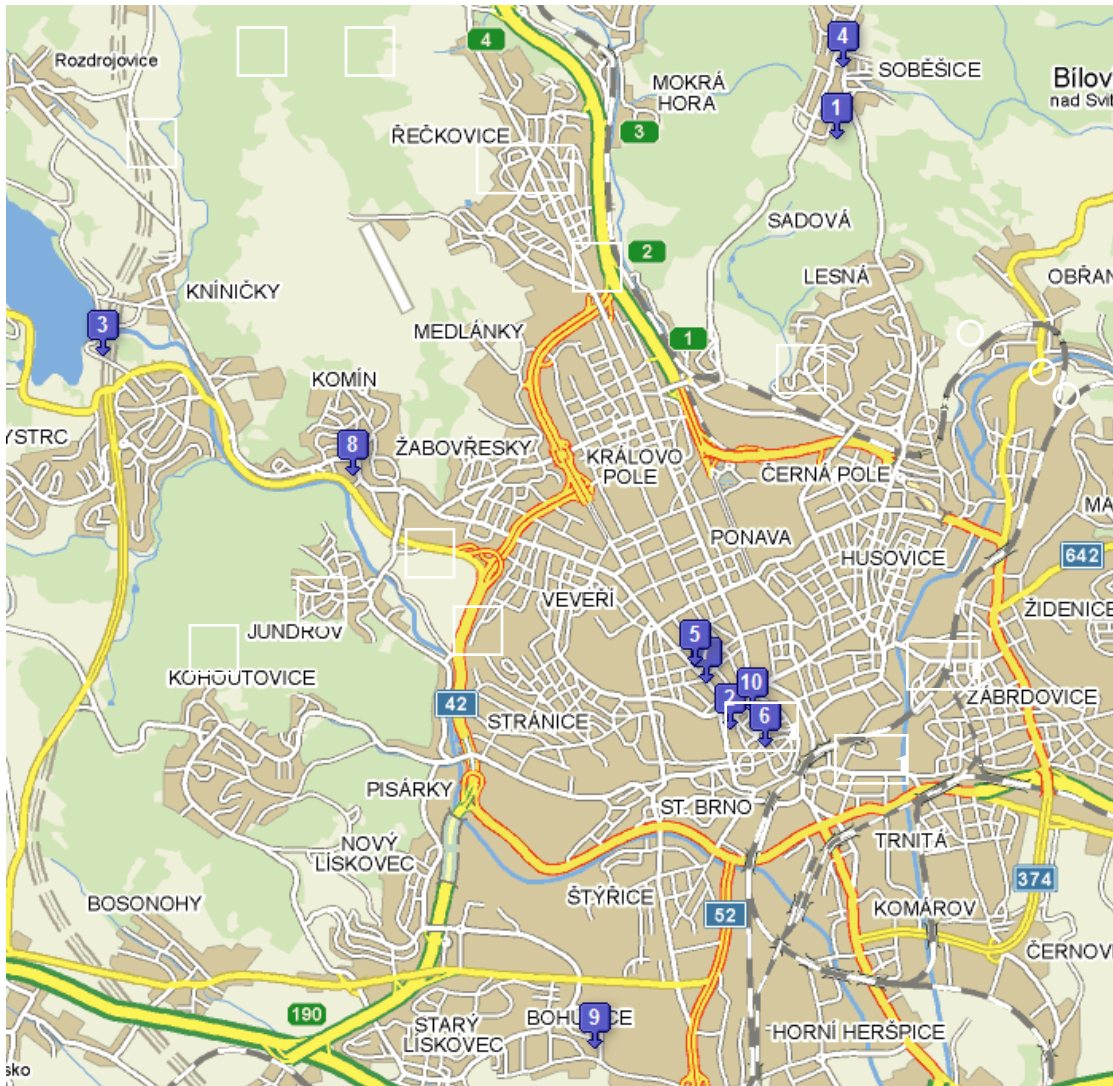
Fig.1 The placements of restaurants

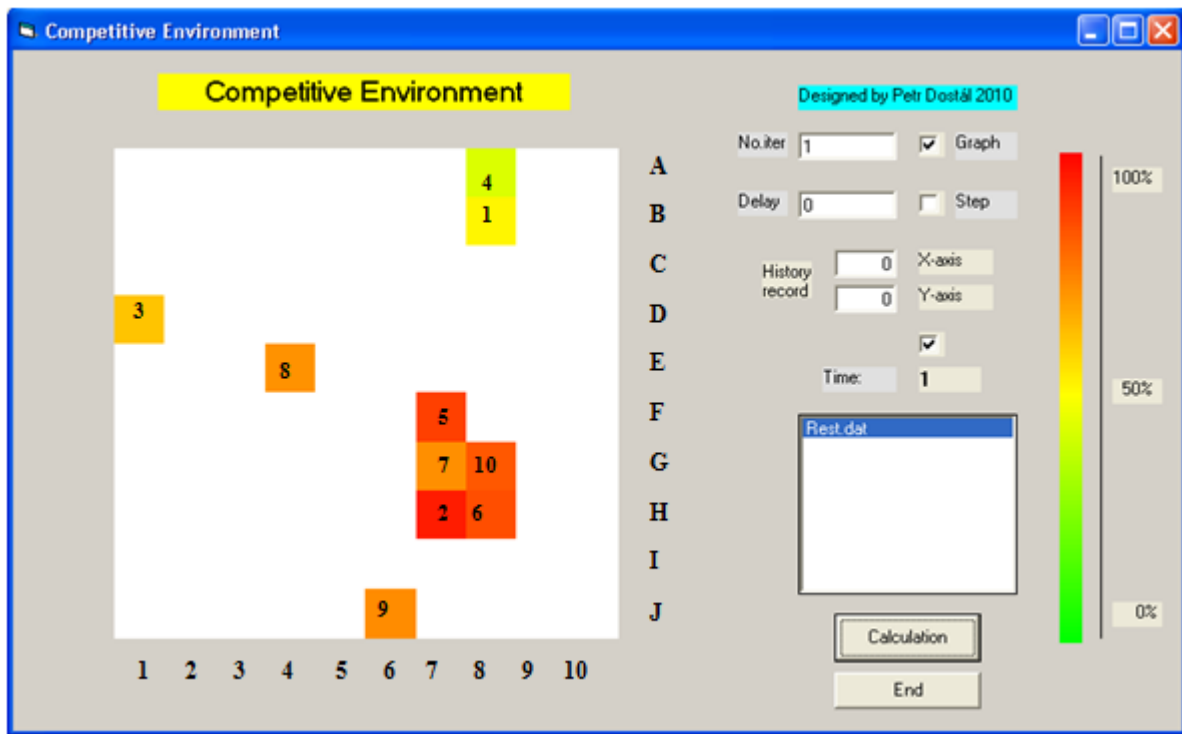*Fig.2 The initial situation of restaurants*

Fig.3 The initial situation of restaurants

The decision making process uses simulation to predict how high will be the decrease of customers during winter time. The simulation calculated the decrease of customers approximately 10% during 50 days of time of simulation. The decrease influenced all searched restaurants. Some are effected more and some ones less. There is no simulation of extra conditions represented by possible advertising campaigns. Also X-mas time is not included in simulation. The results support the idea of decrease of customers and it enables to plan the decrease of number of workers during the winter time. The final state after 50 days of simulated time is represented numerically at Figure 4 and graphically at Figure 5.

The results of calculations is possible to present by a spider graph presented at Figure 6, where the restaurants No. 1, 3, 5, 6, 8 and 9 were drawn in time T_0 (full line), T_{25} (dashed line) and T_{50} (dotted line). The graph enables the present dynamic changes of utilization of restaurants given by customers. The decrease of customers of restaurants supports the solution to decrease the number of employs of restaurants in winter time.

	1	2	3	4	5	6	7	8	9	10	
A	000	000	000	000	000	000	000	036	000	000	
B	000	000	000	000	000	000	000	039	000	000	
C	000	000	000	000	000	000	000	000	000	000	
D	046	000	000	000	000	000	000	000	000	000	
E	000	000	000	049	000	000	000	000	000	000	
F	000	000	000	000	000	000	065	000	000	000	
G	000	000	000	000	000	000	068	069	000	000	
H	000	000	000	000	000	000	078	071	000	000	
I	000	000	000	000	000	000	000	000	000	000	
J	000	000	000	000	000	055	000	000	000	000	

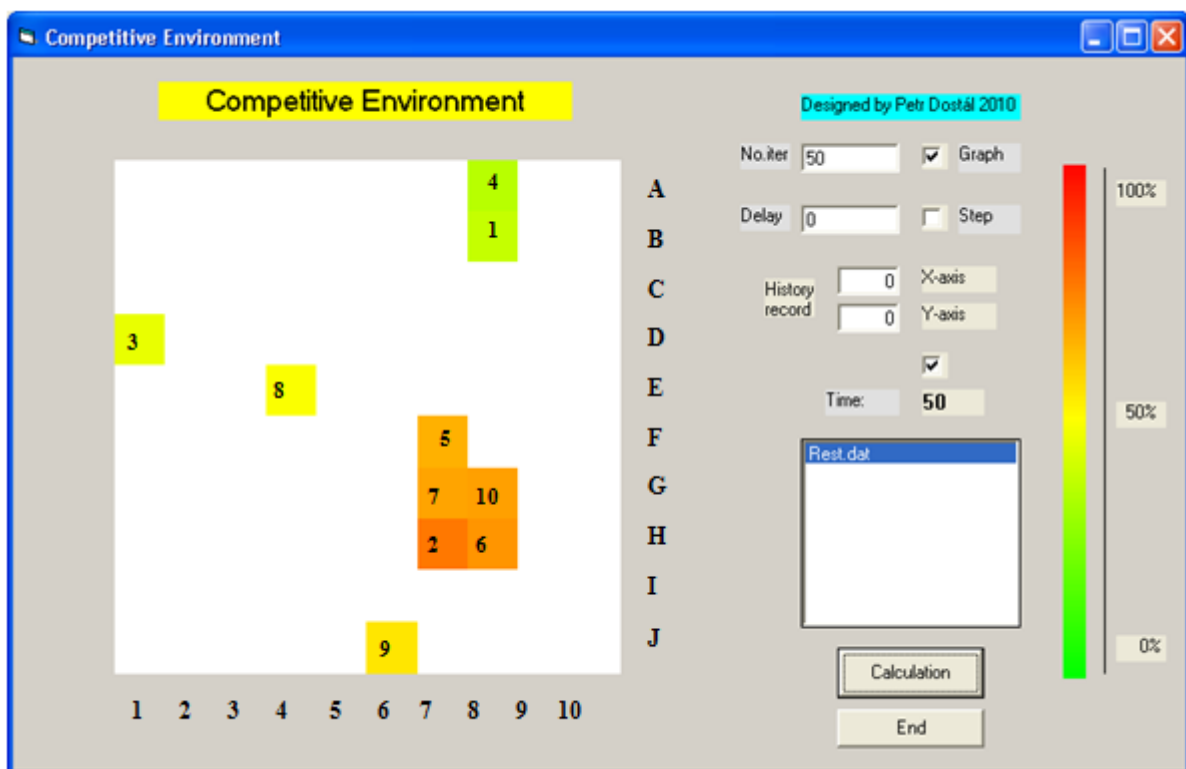*Fig.4 The situation after 50 days of simulated time*

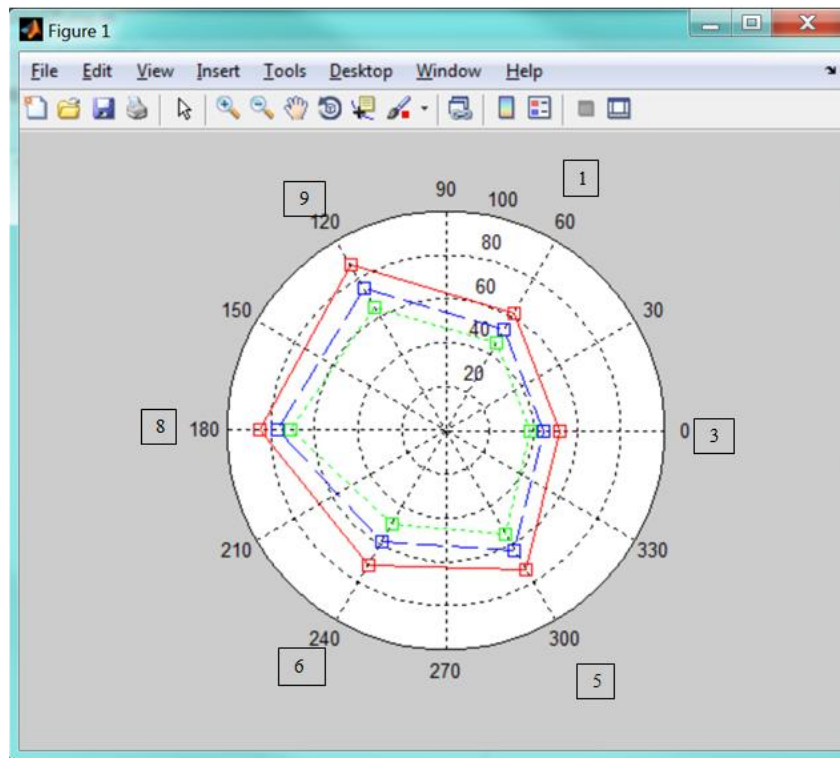*Fig.5 The situation of restaurants after 50 days of simulated time*

Fig.6 The utilization of some restaurants

Discussions

The simulation gives the following results. The decrease of customers is approximately 10% during 50 days of time of simulation. The decrease influenced all searched restaurants. Some are effected more and some one less. There is no simulation of extra conditions represented for example by advertising campaigns. Also X-mas time is not included in simulation. The results support the decrease of customers that enables to plan the number of workers during the winter time.

Conclusions

The mentioned designed model is used for simulation of utilisation of restaurants. The described method of the built up of a model and its realization by suggested program enabled the search for strategy of employment of workers during winter time that are very important for entrepreneurs. The calculation can leads to right decision with the aim to decrease costs and save money of restaurants. The designed methods can be used not only for restaurants but also for example for hospitals, banks, companies, firms, warehouses, suppliers or customer relations etc.