Regional Logistics, Supply, and Supply Systems

Zoltán KOCSIS [a*] – **Mihály** VARGA [a] – **Zalán** KOVÁCS [a]

[a] University of West Hungary, Faculty of Wood Sciences, Institute of Machinery and Mechatronics, Sopron, HUNGARY

Abstract – The design of a logistics and supplier system is especially important if there is a big traffic of goods, many goods have to be supplied, stored and delivered within a given timeframe. An important starting point at the design is the expected vehicle and goods traffic because these determine the basic setup of the system to be introduced (e.g. entry using a doorman, a code, using RFID (Radio Frequency Identification), or entry using license plate recognition, e.t.c), and also the capacities and the of the warehouses (number of loading and unloading points) and the different parameters of the waiting queues of the vehicles like waiting time, processing time, throughput time etc. The identification and analysis of such problems is best done by the means of queuing theory and performance-analysis Simulation is a method accepted nowadays to determine the expected parameters of a system, narrow pass can be estimated and the design of the system can easily be changed. In the case of an existing system the parameters can be compared to those coming from the simulation and differences can be made visible (PREZENSZKI 2000).

The basic research method was to investigate the characteristic parameters of the queuing theory and performance-analysis which are first to be estimated and planned with the design of an appropriate simulation environment (SIMUL8), and then are to be applied after the establishment of the real system and finally to be applied in the real system after a comparison with the real values and an optimization. The main characteristic of the research was that the data had not to be obtained and analyzed from an existing system which then had to be transformed, but we received data covering the important parameters of the system and this way over- or under-planning can be kept on a minimum, which has and advantageous effect on the cost of the investment and operation.

Summary – The new and innovative license plate recognition and access control system developed by the Institute of Machinery and Mechatronics and introduced in an industrial cooperation has a considerable effect in increasing the distribution and commissioning performance of the Huncargo Ltd. This modern and innovative system facilitated an improvement of the niveau of the logistic processes of the Ltd and an improvement in the quality of services connected to these activities. The installation and the set-up of the system is completed and the system has been successfully tested. It can be stated, that the vehicle identification system works well and can further be developed according to the future needs of the Huncargo Spedition Ltd.

Keywords: logistics / simulation / vehicle identification / plate recognition

[*] Postal address: HUNGARY, 9400 Sopron, Bajcsy- Zs. u. 4.; e-mail: kocsis.z@fmk.nyme.hu

1. **DEFINING THE INNOVATIVE SOLUTIONS DEVELOPED BY THE INSTITUTE OF MACHINERY AND MECHATRONICS INT HE LICENCE PLATE RECOGNITION AND ACCESS SYSTEM, DESCRIPTION OF THE FUNCTIONING OF THE SYSTEM**

The license plate recognition and access control system consists of two parts:
-   Hardware of the system (cameras, displays, creation of a software interface)
-   Connecting the software of the license plate recognition and access control system to the store database of the Huncargo Ltd (CargoBASE). This innovative software was developed by the Institute of Machinery and Mechatronics

Additional data provided for the development of the system:
-   Size of a truck: 17,5 x 3 meters
-   Width of the truck: 2,6 m
-   Distance between the fence and the road: 1 meter
-   Size of the display: 2 meters wide and 20 cm high

The arriving trucks are waiting in the parking lot on the right edge of the street at the plant of Huncargo Spedition Ltd in a row after each other. A camera detects and registers the license plate number of the truck (Figure 1.) and forwards it into the database. If needed another camera detects and registers the license plate number of the trailer of the passing vehicle. The cameras transfer the license plate numbers in the form of a file to the central computer.

The second step is the most innovative and difficult part of the innovation of the logistic process. The Institute of Machinery and Mechatronics of the Faculty of Wood Science of the University of West Hungary had to develop a software which establishes a link between the license plate recognition software and the already used logistics database (CargoBASE). This new software has to determine the origin, quality and quantity of the transported goods based on the connection to the store database and the on the received license plate number. This way the updating of the database of the logistic base is accelerated and the administration of the bills of lading will also be trouble-free.

The information about the arrival of goods is immediately displayed on the computers of the store managers and this way the trucks are checked in. The new innovative software serving the new system provides a possibility to determine the loading position of the track automatically or the store manager in charge can determine the loading position. The new software also records the license plate number of the trailer of the truck with a second camera (Figure 2.). This provides an additional important information fro the database system of the store, namely the license plate number of the trailer, because the truck assemblies are sometimes even if rarely parted and the same towing vehicle does not necessarily get the same trailer. The software developed by the Institute of Machinery and Mechatronics (IMM) gives the instructions to the drivers on a digital display on the street front visible night and day (Figure 3.) based on either automatic or manual decision mentioned before. The table displays the license plate number of the called vehicle and its loading position.

-   After manipulation with load the trucks leave the logistics bas eeither empty or loaded, and this is registered by a third camera located also near the reception gate. The hangling of the data of this camera is also provided by the software developed by the IMM.
-   The software developed by the IMM also provides the feature of monitoring of traffic excluding the trucks with the cameras. This traffic consists of the traffic of

maintenance, service and garbage collection vehicles and the cars of the workers and arriving guests.

Figure 1. Identifying vehicles

Figure 2. Identifying entry and exit

Figure 3. Infromation table

1.1. The system administrates the following way:

1.) a) The vehicle moves on the way reserved for waiting vehicles, where the system recognizes it (Figure 4.) After recognition the system administrates the vehicle and sends a greeting message to the recognized vehicle, and then the recognized license plate number appears among the waiting vehicle numbers. The vehicle remains in the queue until it receives a signal to proceed in. This signal can be triggered by clicking on the desired license plate number (function button "Let in"). The a message appears on the information table that the vehicle with the given license plate number should proceed in.
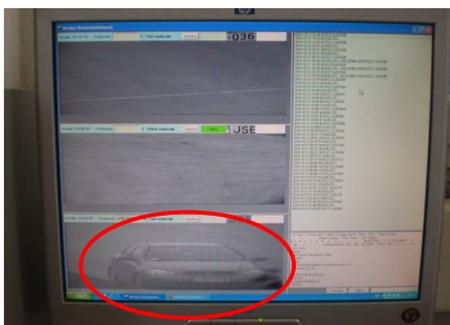

Figure 4. Identifying arriving vehicle

Figure 5. Greeting message

1.) b.) The vehicle moves out of the waiting queue and proceeds to the barrier at the entrance. (Figure 6.) There is another license plate recognition which is also registered and the barrier opens automatically. The vehicle is removed from the waiting queue and is further in the list of vehicles inside the logistic base.

Figure 6. Identifying vehicle entering the site

Figure 7. Identifying vehicle leaving the site

1.) c.) When leaving the site the vehicle generates another reading standing at the reading camera (Figure 7.) which is the registered by the system and the vehicle is removed from the list of vehicles inside the site.

2.) a.) The vehicle simply stops before the barrier at the entrance. (Figure 8). Then there is a license plate number recognition, the barrier opens automatically and the vehicle is put on the list of vehicles inside the site.

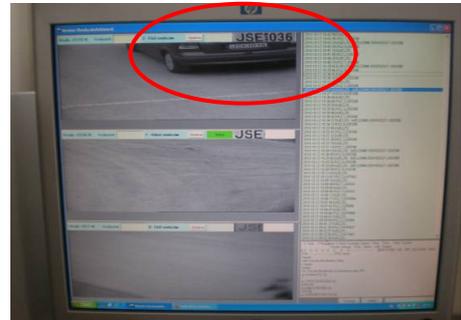*Figure 8. Arrivel of a vehicle to the site leaving vehicle*

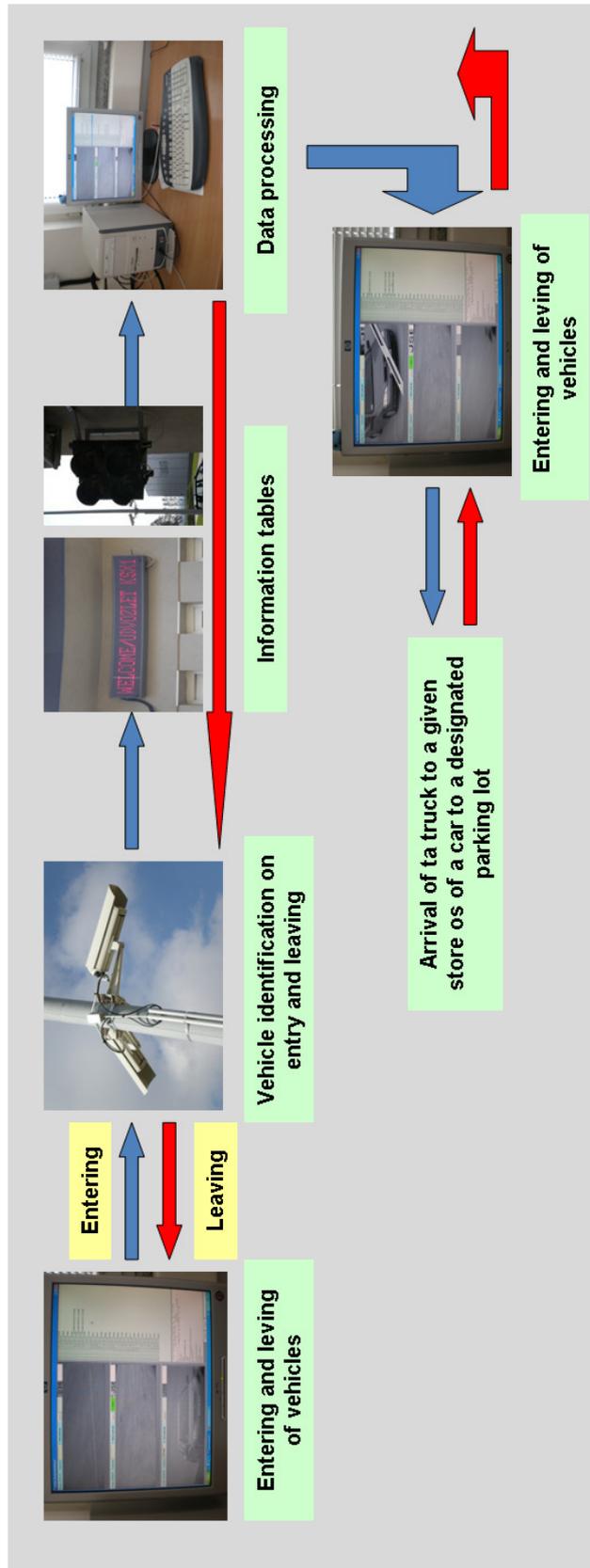*Figure 9. Identifying the licence plate number of a leaving vehicle*

Figure 10. The model of the license plate recognition system developed by the IMM

2.   SUMMARIZING THE EXPERIENCE IN OPERATING THE VEHICLE IDENTIFICATION AND ENTRY SYSTEM DEVELOPED BY THE IMM

In the following we summarize the observations and possible problems gathered during the testing of the system the correction of which is inevitably necessary to the perfect operation of the system:

- The one information display presently available is not enough fro the perfect completion of the tasks, because vehicles standing at the front of the waiting queue can cover the necessary information for vehicles at he end of the queue.
- The present system does not provide sufficient information about the actual state of the slots.
- The turning radius of the vehicles is not proper so the error-free license plate number assessment cannot be guaranteed.
- The present system cannot differentiate between trucks, small lorries and car. The reason for this is the different geometrical location of the license plates. Thus the system recognizes the incoming vehicle traffic, but cannot decide if it is a truck, a lorry or a car.
- At present the impulse control has a problem at the entrance barrier (inductive control system error) when the system receives 2 different signals at the same time. The two signals are the GSM door opening system and the installed entry system.

3.   DEFINING FUTURE GOAL FOR THE DEVELOPMENT OF THE VEHICLE IDENTIFICATION AND ENTRY SYSTEM DEVELOPED BY THE IMM

In the following we summarize the future development possibilities for the vehicle identification and entry system developed by the IMM:

- In order to get sufficient information about the state of the slots (busy or not busy) additional cameras have to be installed which are in connection with the store database and together with this with the entry system.
- In order to improve the reliability of identification the speed of the vehicles has to be reduced to about 10 km/hour.
- To ensure uniform turning road marking have to be applied.
- To enable the system to identify the different kinds of vehicles a height camera has to be installed at the identification.
- There will be a possibility (after development work) to receive orders by E-Mail and their integration into the store database of Huncargo. Based on this the expected time of arrival can also be submitted. The system will let the vehicle in based on the entered time in (not necessarily in the sequence of arrival)

References

PREZENSZKI, József (2000): Logisztika II (módszerek, eljárások), Budapest. 477-551 pp.