EHEALTH INFORMATION AND SIMULATION MODELING

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Abstract

Various aspects of simulation modeling using Matlab Simulink are considered in this study. Attention is focused on simulating the procedure for issuing European Health Insurance Card from the competent authorities. The presented simulation model is developed on the basis of the regulations describing the procedure for issuing such a card in Bulgaria. The study ends with an analysis of the results of the simulation and identification of the opportunities for optimization of the procedure. The results are obtained in the project "Simulation Modelling of Administrative Services and Processes for e-Serving and Management", funded by the grant for research at the Technical University of Sofia. The author is leader of the team of the scientific project.

1. INTRODUCTION

The improvement of the automated electronic services requires application of a systematic approach for simulation modeling to test and evaluate the parameters of the service quality. The service quality requirements must be combined with the level of service from input to output, taking causation so as to ensure the network characteristics that define the communications between separate administrative units.

2. SIMULATION TOOLS

A few stages of simulating the procedure for issuing European Health Insurance Card (EHIC) using Matlab Simulink are considered in this study. The presented simulation model is based on the regulations describing the procedure for issuing such a card from the competent authorities in Bulgaria.

The capabilities of MATLAB Simulink [1] - [7] for modeling dynamic systems are demonstrated, which enables the realization of the relevant principles in other areas. Only standard blocks are used for portability and compatibility of the model with older versions on other workstations. Matlab programming environment was chosen because of the superb opportunities it provides for the simulation of models from all areas of science and technology and its wide distribution among researchers in these areas.

3. Ehealth SIMULATION PROCEDURE

Decision Scheme in the MATLAB Simulink environment is built of subsystems, each of which presents institutions through which the documents are passed (Figure 1). To start the procedure documents are submitted in the subsystem „Customer" (Figure 2). The subsystems "Current number verification", "Appeal against refusal" and "Issue of EHIC" are joined to this subsystem.

Block "Registering with an incoming number and classification" presents RHIF register, which brought the documents submitted for the EHIC. Block "Check for paid health insurance contributions" in the real system is confirmation of continued health insurance rights of the client. "Issue of EHIC" subsystem is under the jurisdiction of the NHIF. The block "Archive" is a virtual model of the archive of the NHIF.

3.1. Subsystem „Customer"

The documents are divided into two blocks (Figure 2):

1) Medical epicrisis and photoes that are made by step generators having in mind the accessibility of these documents and in most cases a single issue.

2) Copy of Birth certificate, copy of identity card or passport and document for paid taxes are generated by pulse generators in view of the frequent need for issuing such documents.
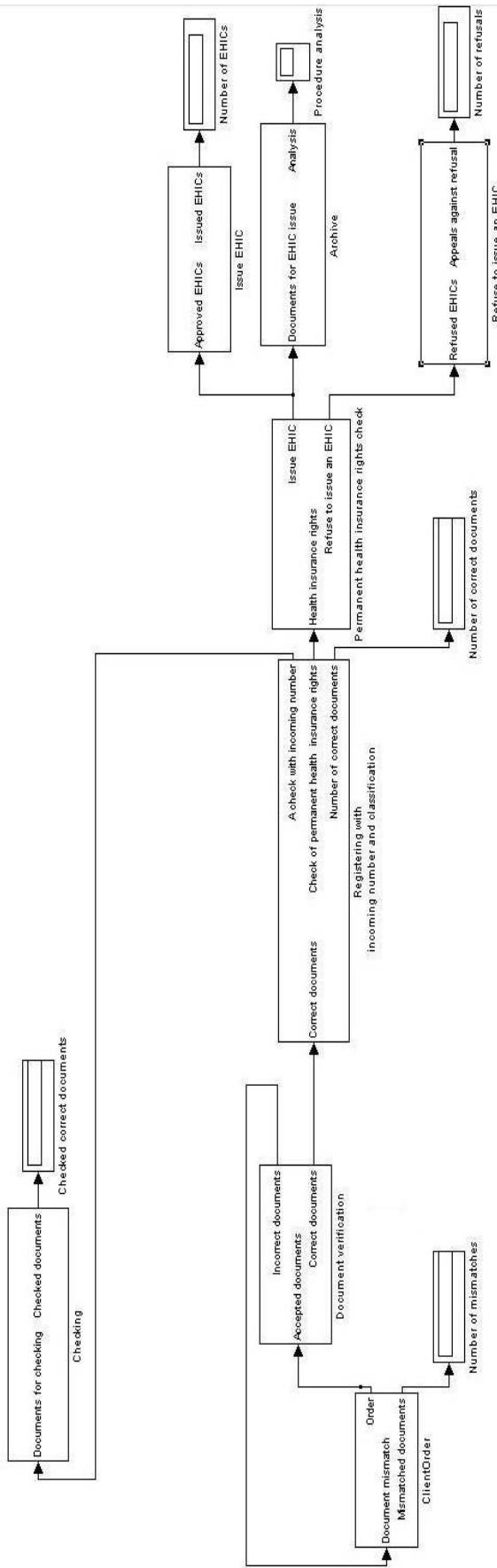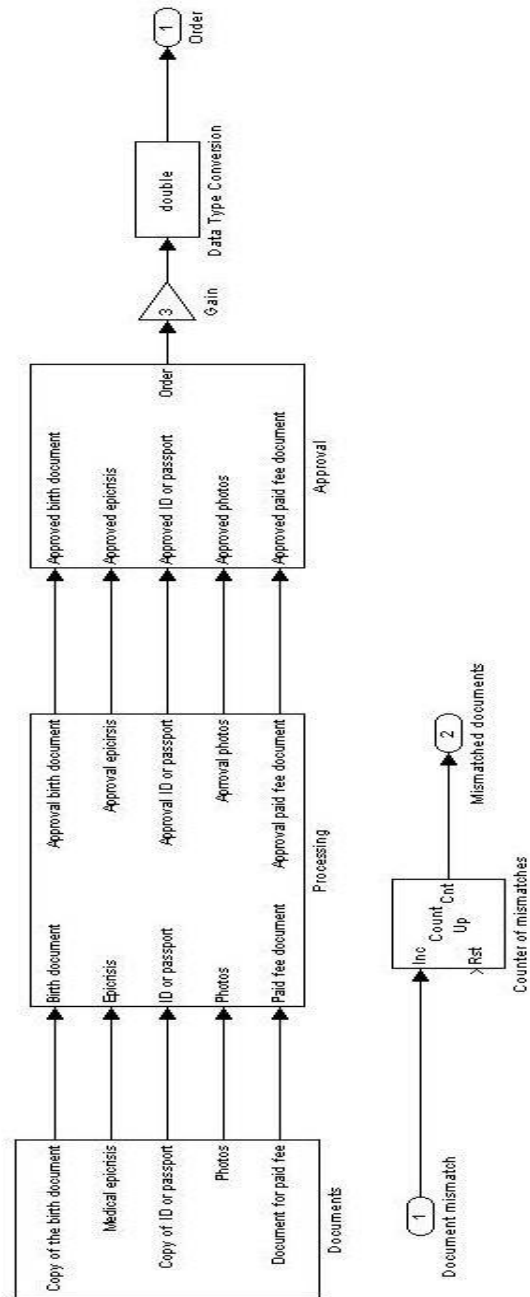
Fig. 1. Overall Simulation scheme

Fig. 2. Subsystem „Customer"

3.2. Subsystem "Documents confirmation"

In order to prevent interference the amplitude of the output signal is increased before the output of the upper subsystem. The same subsystem contains a feedback block "Documents confirmation" (Figure 3), which is connected to counter considering the number of unfair documents.

The verification of the correctness of the documents is conducted in accordance with the above logic. Each amplitude of the signal with a value other than zero is a correct document and vice

versa. For the purposes of the functions performed by this block are used two standard blocks to check the amplitude of the input signal. Any incorrect set of documents is returned to the subsystem „Customer" to be processed there.
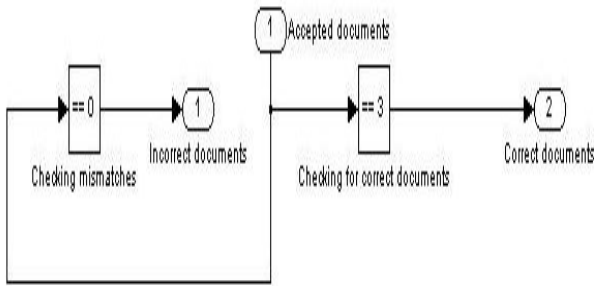

Fig. 3. Subsystem "Documents confirmation"

3.3. Subsystem "Registering with an incoming number and classification"

Once the documents are adopted by employees of the regional health insurance fund, they are registered with the registration number and classified. During the process of classification documents are sent to be checked on incoming number in the subsystem "Verification of incoming number" (Figure 4) and to check the insurance status of the sender in subsystem "Check for paid health insurance". Additional functionality of the subsystem is added by finding the number of correct documents.
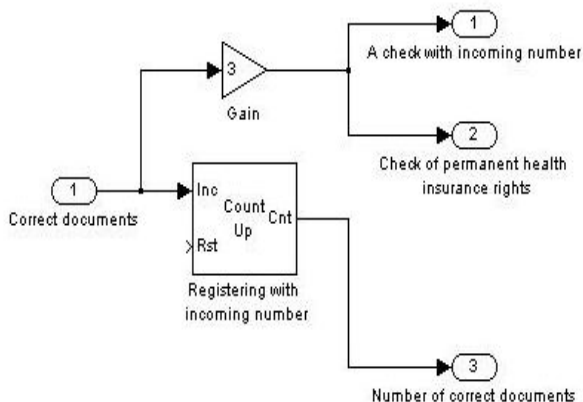

Fig. 4. Subsystem "Registering with an incoming number and classification"

4. SIMULATION RESULTS ANALYSIS

The simulation procedure for issuing EHIC was carried out throughout 480 units with the assump-

tion that this is the duration of a working day in minutes. For the other studies the duration of the simulation can be changed as the duration and time unit.

A "right" logic is used in the whole scheme (Figure 5). Each signal amplitude value of zero can be interpreted as an incorrectly filed document, incomplete set of documents or lack of documents for processing. If the amplitude value of any signal from the scheme is different from zero, it is interpreted as a complete set of submitted papers, documents or correct processing of documents.
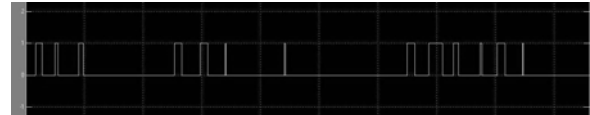

Fig. 5. Simulation results

After a careful analysis the percentage of incorrect documents, lack of full set of documents, the senders with unpaid health insurance contributions or discrepancy between the number of incoming documents may be determined. This analysis would be used to determine the reasons for the shorter and longer processing applications. It can take information to serve as a basis for further optimization of the procedure at its various stages.

5. CONCLUSION

This simulation model is widely applicable in the field of eGovernment, because of the potential for fast modification of the model for other procedures. After deposition of modifications on the model, it can be used for determining the bottlenecks in the information flow and to optimize the processing of documents in local or global plan of any e-service.

The advantages of the simulation model are easiness to work with the model, the opportunities to regulate the duration of the simulation, model portability between computer systems with different software and/or hardware and compatibility with older versions of the programming environment. Unlike other abstractions of the procedure for issuing the EHIC this model allows rapid and significant changes in amendments to the regulations describing the card issue. This model is applicable for both an employee and the department or the whole system. Quick and visually easily distinguished analysis is to be made by changing the input parameters.

6. APPENDIX AND ACKNOWLEDGMENTS

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