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IMPLEMENTATION OF ALGORITHMS FOR MANAGING COMMUNICATION CHANNELS OF AN INTELLIGENT AGENT IN A COMPLEX TELECOMMUNICATION NETWORK

With the development of telecommunications technologies, the increase in speed and volume of information transmission, and the emergence of resource-intensive network applications, the management of data transmission networks has become an important issue. In the case of communication networks, management is reduced to processes of monitoring and controlling the state of nodes, lines, and interactions between nodes.

In modern technologies and hardware implementation of communication networks, multi-agent systems are widely used as distributed (decentral-

ized) management systems. The basic element of this system is a managing agent (MA) which is responsible for a certain area of the network and exchanges service information with the nearest agents. The MA can be built on the basis of an intelligent network device, such as a managed switch, router, or server with specialized software that contains algorithms for managing the network area for which the agent is responsible.

Cameras with a wide dynamic range, which are capable of recognizing necessary objects in poor lighting conditions, are becoming increasingly widespread when building telecommunications systems. If a DSP processor is used as a camera data processing device, then the problem arises that the bandwidth of the DSP processor is insufficient for processing signals from cameras with a wide dynamic range. In addition, these devices do not provide additional video surveillance functions, such as video analytics.

The solution to this problem may be the use of programmable logic integrated circuits (PLCs), which have sufficient bandwidth to be used as a coprocessor for performing image processing from the video signal sensor and transmitting video streams to the DSP processor for video encoding, for example, in H.264 format, as well as implementing communication channel control algorithms. For example, Intel FPGA PLCs allow adapting the camera to different image sensors and specific interfaces. In addition, as analog cameras are replaced by intelligent IP cameras and video analytics processes are improved based on deep learning algorithms, PLCs are becoming increasingly in demand in such systems. The Cyclone and Arria PLC families are capable of parallel processing large volumes of data, and they can be used as a video processing accelerator on the edge computing platform for video data analysis.

A decentralized telecommunications network management system based on managing agents has been chosen for research. This paper considers the implementation of MA algorithms, which are designed to select the optimal channel or set of channels with minimal bandwidth and cost for transmitting the output information flow in a decentralized agent-based management system. The entire control algorithm can be divided into two components: the bandwidth determination algorithm that belongs to the communication channel agent, and the algorithm for selecting the appropriate transmission paths for information based on QoS criteria.

As known from node power consumption analyses, for example, in a wireless sensor network, the main part of the power source's energy is spent by the node on receiving and transmitting data, rather than processing it. Creating a buffer of collected information is a justified solution from the point of view of reducing the energy consumption of the telecommunications system node.

After analyzing the advantages and disadvantages of possible hardware implementations of the aforementioned management algorithms, the authors propose the implementation of a system of controlling algorithms and a buffer of received information on a programmable logic microchip, which will help increase the speed of information processing through process parallelization, reduce the energy consumption of network nodes by using a buffer, and reduce the number and length of connections in the scheme by using a single microchip.