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EMBEDDED MODEL SYSTEM REALIZATION

Before moving on to the issue of embedded systems, everyone needs to understand the basic concept. A system is generally a device in which all elements in an assembly work together according to a set of rules. It can also be defined as a way of working, organizing, or performing one or more tasks according to a fixed plan. An embedded system in simple terms means something that is related to something else. An embedded system can be thought of as a computer hardware system in which software is embedded. These types of systems can be an independent system or a part of a larger system. Embedded system can be presented on the basis of a microcontroller or microprocessor, IoT or cyber-physical systems. The system must be designed to perform a specific task [1].

So, an embedded system consists of three components:

- application software
- hardware subsystem
- real-time operating system (RTOS).

RTOC monitors the application software and provides a mechanism for the processor to start a process on a schedule, following a latency control plan, defining how the system works. It sets up rules at runtime. A small embedded system may not have an RTOS.

Thus, the embedded system is based on a microcontroller, software controlled, reliable real time control system [2]. To build application systems and embedded models, certain characteristics of the embedded system must be observed:

- single functionality
- hard restrictions
- reactive and real time
- base
- memory
- connection.

As a software solution for embedded systems, we offer the E-net Model System (EMS), a distributed modeling system developed by us, which allows to create distributed models based on the formal apparatus of hierarchical E-networks within the HLA architecture [3].

The developed EMS system has a client-server architecture. In addition to the distributed mode, the system also supports a single-processor simulation mode. This mode can be used for debugging models and in the process of modeling non-resource-intensive tasks.

The system is accessed through a browser. Therefore, on the client side, the user does not need to install or run any additional software. Using the subsystem of the graphical interface, the user creates a model in the graphical editor of the system, configures the experiment and starts the simulation process itself. In this mode, the entire modeling process is performed on the web server. Based on the simulation results, it is possible to view the results in the form of tables, graphs and histograms. The results obtained, as well as the developed models, are stored in the database.

In the distributed modeling mode the models are executed on the modeling servers. Beforehand, the EMS system must be installed on the modeling servers and the RTI must be running on the web server.

As in the uniprocessor simulation mode, the user connects through a browser to the system's graphical interface on the web server and creates models in the graphical editor. To work in distributed mode, you must first create and run a federation on a web server, then create a federation based on the developed aggregates. During the creation of a federation, the user creates a connector module (CM) for each aggregate and specifies the IP address of the modeling server from the list of available ones, on which this federation will be performed. The experiment parameters are configured on the web server using the experiment subsystem [4].

The communication between the web server and the simulation servers is provided by a communication module. Its tasks include sending the configuration of federations created on the web server, receiving simulation results, and also managing the work of federations, including starting, stopping, and reloading federates on the simulation servers. The work of federates is controlled by transmitting a sequence of commands (set, get, call). Thus, the simulation server receives all the necessary settings to run the simulation, namely: the federation name, the federation name and the aggregate name from which the federation was created, the configuration of the input / output CM interfaces of this federation, and the parameters for running the experiment.

The accumulation of statistical data takes place on the modeling servers, at the end of the modeling, the results are transmitted to the web server to the statistics collection subsystem, where the final report is generated.

Interaction and synchronization of federates during distributed modeling takes place using RTI services and the developed CM module. RTI is launched on a web server, federates interact with RTI using specially designed CM interfaces.

The main object of the kernel is a model that stores the current model time, the end time of the simulation, and a time list of events. An aggregate is used to store the structure of the model. It can contain transitions, positions, queues, inputs, outputs, and nested aggregates inside. The model contains a reference only to the root aggregate; it is the objects of the root aggregate that are taken into account when the model is run. Thus, in essence, a model is also an aggregate and can be used precisely as an aggregate in other structurally more complex models. The main difference between the model and the aggregate is that the latter cannot be launched to carry out experiments and collect statistical data.

Variables defined by name, type and value can be defined at both the root and nested aggregate levels. The scope of a variable is determined by the aggregate in which it is created and the aggregates of its children [5].

The label is determined by the position at which it is set, which allows to create several labels in the aggregate with a different set of attributes. Each attribute, like a variable, is characterized by a name, type and value.

In this article we offer the E-net Model System (EMS), as a software solution for embedded systems, which allows, in a remote access mode on the Internet, to create in a graphical mode, easy for perception and further reuse, distributed models of discrete and continuous processes, as well as to conduct a wide range of experiments with them.

References

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HOISTING MACHINES

There was a need for hoisting machines a lot of years ago. It was difficult to meet the needs of the automotive industry. Nowadays, in various industries, manipulators are used to perform technological tasks.

Most of the market products in Ukraine remained domestic. However, young engineers who have created new products are already competing with world markets. As well as abroad, in Ukraine the factories produce a variety of hydraulic hoisting and transport equipment. So, we will consider in details how the market for this type of equipment has developed.

First, you should pay attention to the Spanish type of the crane "Grua Portatil Para Taller" [1] (fig. 1-a) with its advantages and disadvantages. Since now in the XXI century they continue to improve or manufacture from scratch technologies borrowed from ancient times and domestic original solutions of complex tasks for hoisting and moving loads [2].

A portable Spanish crane is used for hoisting to a height. It has a rotating mechanism, a universal A-frame made of welded steel channels and a three-point bracket that allows the unit to stand securely on uneven floors. The low platform of such a crane can be placed under the front of any vehicle, and the vehicle engine can be returned to its place using a worm winch. However, the portable hoist has disadvantages: the complexity of the structure; overall dimensions; the cable and carriages are subject to wear when the cable slides over the flange if the carriage is not positioned; if the cable slips out of the groove, it can become stuck between the carriage and the tongue, making it nearly impossible to free the parts without damage.

We will consider three types of new generation cranes, taking into account the disadvantages and advantages of each separately.

Norco 78600B 3T Capacity Air / Hydraulic Floor Crane (fig. 1-b) [3]. The advantages are the following: a comfortable boom position and lengthening of the legs provide maximum stability; the boom returns 10 ° to the right or left if the base cannot be centered under load; the floor lock prevents the crane from moving during operation. The disadvantages include the following points: only a qualified operator can work with the structure; high cost; the complexity of the design; difficulty in repair (you must contact the manufacturer Norco Industries directly) used only on a hard, level surface; the load can swing, which causes the crane to overturn; many storage requirements; sold to official companies in series.

"Canbuilt Arm Hydraulic Crane Model №5200" (fig. 1-c) [4]. Canbuilt Manufacturing is a division of Sayco Distributors Ltd., a Canadian company founded in 1969 and headquartered in Toronto. The advantages of such a crane: double control - pneumatic / manual hydraulics; the "flow base" allows the legs to be fully retracted or even installed from the back for unobstructed lifting; versatility; counterweight addition; provides parallel and horizontal lifts; compactness;