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Make Harmony Between Technology and Nature, and Your Mind will Fly Free as a Bird
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DEVELOPMENT OF REMOTE EDUCATION TECHNOLOGY ON A BASE OF MOBILE ROBOT SYSTEM ROBOTINO

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Abstract: *This article is dedicated to proposals of Karaganda state technical University (Kazakhstan) within the bounds of "Synergy" International education project. The main point of these proposals is use of playing principles for the arrangement of remote education. It's supposed to use these playing principles for "Synergy" project participant-universities' students education arrangement. For realization of these playing principles development of time and distance passing accuracy hardware control system is accomplishing.*
Key words: *remote, education, training, mechatronics, robotics*

1. INTRODUCTION

Karaganda state technical University (KSTU) participate in International "Synergy" project.

Within the bounds of this project integrated mechatronics training laboratory was created based on training equipment of FESTO concern.

In this project participate Universities of Russia, Ukraine and Kazakhstan (http://www.mpei-festo.ru/partners.html). The students of named Universities have an access via Internet to any training stations which are a part integrated laboratory.

2. SINERGY PROJECT

The "Synergy" project aims to create opportunity to network better laboratory facilities of various Universities (Breido et al., 2009, a). This creates the possibility of saving money on the purchase of equipment each university. Also in the project brings together best teachers of this Universities.

In Karaganda State Technical University has the following MPS stations producted by concern FESTO: distributing station, buffer station, robot with a assembly station, handling and sorting stations. And besides there is the robotic system Robotino.

Distance learning in the project "Synergy" is carried out through the implementation of the course labs.

Students receive an assignment to design a control program for one of the MPS stations, located at the university participates in the "Synergy" project. According to the instructions received, a program for industrial controller S-300 in the software environment STEP-7.

Next you are debugging on a visual immitatore stand in a software environment «Cosimir». After debugging the program the student is connected with a remote server, and poisons the program via the Internet archives of the FTP protocol by means of a university, which has a training stand. The remote computer received the data packet makes loading programs developed in the controller training stand. Runs educational stand at the same time by recording the process and using web-camera via the Internet in the on-line by visual inspection of the stand, parallel documented state sensors control system. After the end of the booth package containing the video clip and the state table sensors, on-line or off-line mode, returning student. In the case of a student job in full, he gets the credit, if errors have been identified, the process repeats until a positive result.

This technology was developed by the project participants Synergy before joining it KSTU.

3. DEVELOPED TECHNOLOGY

Within the bounds of this project KSTU developed remote education technology on a base of mobile robot system Robotino (Breido et al., 2009, b).

Main point of this technology is the using of playing education principles, implying in absentia project participants competition. Structure of the remote access to Robotino shown in figure 1.

The teams of two Universities via their own server connect to Robotino situated at KSTU.

We are proposing remote training of participants as a first stage before the main competition.

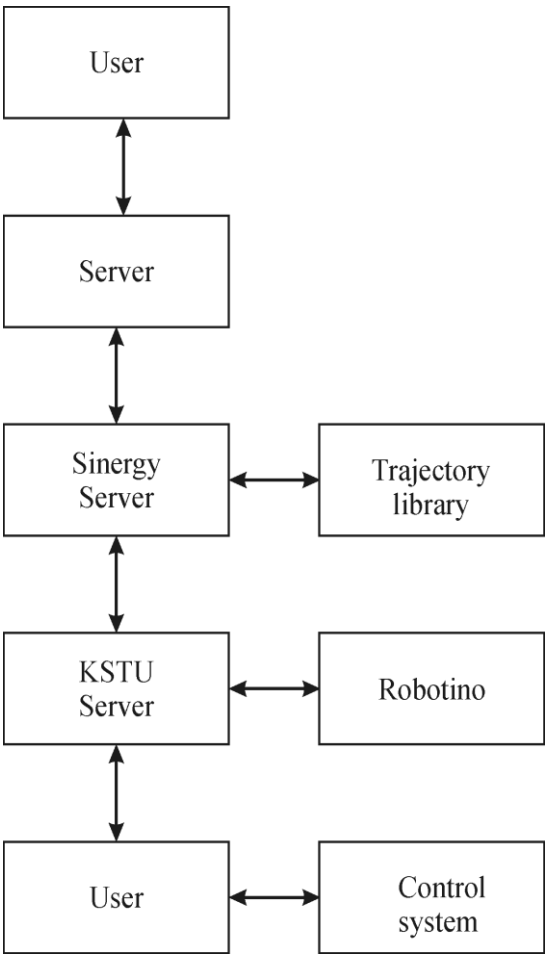

Fig. 1. Structure of the remote access

On this stage they work through their programs and skills of work with mobile robot system Robotino software "RobotinoView", which is free available on Festo's website. The training course lasts for a few days. Each team receives a set of given movement trajectories for Robotino. After that qualifying selection of pretenders for a competition participating is supposed. Each of pretender is given an opportunity to pass testing examinations for working through own Robotino control algorithms (Feshin et al., 2009).

On a stage of main competition each of the participants is given a defined trajectory. Robotino must overpass it in an established time. There are a set of obstacles with an optical sensors on a given distance. These optical sensors serve as check points. The winner is a team, whose Robotino reach faster and accurately finishing line.

Teams with a help of RobotinoView software develop control programs for a defined trajectory. After that they send the programs to us and we download program to Robotino. Then using a start lamp robot starts the movement by defined trajectory. Trend of competition records by detached web-camera and sends to the participant.

It is necessary to fix precisely the distance passing time of participant for the correct and accurate organization of proposed by us education principle. It is assumed to create hardware system, which could provide an automatic giving of a start signal, trace accuracy of passing given trajectory, time of distance passing.

Participant starts with turning on of start lamp. The camera mounted on Robotino perceives this signal. And with accordance of control algorithm robot starts the movement.

The tracing of distance passing accuracy realized by check points mounted along the whole distance. Check points are gates with a pair of oscillator and photo receiver. With a breaking of signal on a photo receiver hardware will detect passing of participator (Robotino) through the check point. Thus the accuracy of distance passing will be controlled (Markvardt & Satenov, 2008).

On figure 2 is presented an example of movement trajectory, which could be used in competitions and during of development of control algorithm for robot system. It could be simple geometrical figures and forms: zigzag movements, circle loops, line trajectories and etc.

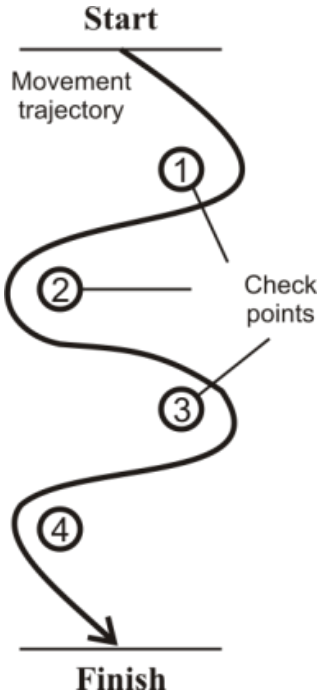

Fig. 2. Examples of movement trajectories

Control system will be realized on a base of MITSUBISHI Electric programmable logic controller ALPHA2 (ALPHA XL). Optical sensors and start button will be connected to inputs of PLC, and start lamp will be connected to outputs of PLC.

The structure of control system algorithm could be realized in that way: start realized by giving of start signal by a remote laboratory engineer. At that PLC turns on the start lamp and turns on a timer. As a passing of the distance participator must follow the given trajectory passing through the check points.

With the passing of finish line the distance time is fixed. With that if PLC detects passing through all of the check points then elapsed time will be registered given out to a front panel of PLC.

For the performance of competitions it is possible to use a few of robot control methods.

First method is to control Robotino in on-line mode. It means that each of participators can watch trend of competitions via web-camera mounted on robot. In this mode device control remains. But the quality of Internet connection could affect on stability of video. In these cases it is possible to perform competitions in off-line mode with remaining of device control.

We have created a guide for laboratory work using a robotic complex Roborino. It tested in the learning process for local access to the robot. In the near future to implement the developed technology for use in the Synergy project (Murdalova et al., 2009).

4. CONCLUSION

The training method with the usage of competition principles has a high effectiveness. This method increases craving for knowledge and achievement of mechatronic system control skills.

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