Laboratorial biochemical model and web automation.

Abstract: Laboratorial biochemical model is part of a project of modern laboratory of integrated automation. It gives new possibility to research of the biotechnology and technology of environment. The students can have a new way and direction by work with laboratory tasks and a remote experiments. It is the method using internet communication. The models are really functional in laboratory. Project consists six models in the first period. The paper presents design and specification of model in the system.

Key words: remote measurement, internet, communication, remote model, biochemical model.

1. INTRODUCTION

Project of new laboratory solves and implicates a new way of education a research of integrated automation and technology. The laboratory system has 6 really models in the first period. The models work own and separately. They can use as locally as remote. The models are connected to Ethernet LAN and are accessed by Internet too.

The student can know and learn the communication, the measurement and work with the remote technological experiments. The paper presents design and specification the biochemical model of the all system.

2. SYSTEM OF LABORATORY OF WEB AUTOMATION

In the last time some new ways are developed in the field the automation laboratory very intensive (Lustig, 2004, Smutny 2005). Many universities collective present their works at the conferences, in professional journals and other publications. They use at most a virtual laboratory. Only in a bit works there are interested really models.

[FIGURE 1 OMITTED]

The new laboratory system of integrated automation has a structure according to scheme in Fig. 1.

The system works in segments of LAN. Our project has in the first segment of LAN some equipments of:

--master server HTML

--slave servers HTML of the DE1, DE2 up DEn experiments.

One from the segments has slave server HTML for the DE5 experiment that is the biochemical model. The place of the one is in next building about 5 km far from master server.

The every experimentally model is really equipment at technological or technical basis. In all project there are designed 7 models. They are:

--DE1 model of control system

--DE2 model of heat power plant

--DE3 model of flow equipments

--DE4 model of control of motor speed

--DE5 model of biochemical process

--DE6 model with communication RS232/LAN

--DE7 model of more communication level.

The models have connected their analog and digital inputs on computer unit. Possibly there is PLC (Programmable Logic Controller) unit or IPC (Industrial Personal Computer) unit. In project there are designed for DE1, DE3, DE4, DE7 the PLC units. The IPCs are designed for models DE2, DE5, DE6.

Every unit has to have possibility of communication direct to LAN. The OPC server solves this problem by the PLC. The PLC collaborates with master server HTML. The IPC units run under operation system Microsoft WINDOWS and have direct connecting to LAN. The general structure of model is in Fig.2.

[FIGURE 2 OMITTED]

3. STRUCTURE OF MODEL DE5

The scheme of structure of model DE5 is showed in the Fig. 3. The basis of equipment of biochemical model is a laboratory fermentor. It has volume about 0,02 m3. In the bottom cover there is a motor for mixing with a motor M1. The housing is a glass. The upper cover is carrying inputs for sensors, for heating and for dosage of acid or alkali and airing.

The actors for the fermentor are projected:

--unit for control of rotation of motor M1 (for mixing of liquid into fermentor)

--unit for switching of motor M2

--unit for batching through valves H1 and H2

--unit for heating E1.

[FIGURE 3 OMITTED]

In project is designed the measurement:

--B1: temperature (0-100[degrees]C)

--B2: level of solution (0-0,35 m)

--B3: conductivity (0-1 S/m)

--B4: pH of solution (1-14 pH)

--B5: concentration of dissolved oxygen (0-20 mg/l)

--B6: ORP--oxidation reduction potential (-700 mV to 1V)

--B7: turbidity (0-50 mg/l)

--B8: pressure (0-20 kPa)

--B9: volume of methane (0-10 %)

--B10: volume of carbon dioxide (0-2000 ppm)

--B11: flow

--B12: speed of mix (0-30 rr/s).

5. INSTALATION OF SENSORS

Very critical moment of project is a selection of correct and precise sensors. The construction of fermentor is showed in the fig. 4.

[FIGURE 4 OMITTED]

All sensors have to install trough the upper cover. The one has some grommets for three using. The scheme of upper cover is in Fig. 5.

The sensor was selected according to requirement of the technology. The complicated solving was the implementation the sensors into up cover of fermentor.

The students use the experiment in variable tasts. They make direct an identification of system by the model or through the internet in the first step. Than they calculate the new parameters of controller and change their makes the new experiment. The results are evaluated according to quality of control.

The researchers can use the model to measure and control all the important parameters of the biological process (treatment of sewage, fermentation etc.)

Central basic unit is projected for IPC unit of type Datalab. The unit has analogue inputs (8AI), digital inputs (8 DI), analogue outputs (8 AO) and digital outputs (8 DO) connected to transmitter of sensors. IPC works into serial communication USB and into LAN. The scheme is in Fig. 6.

[FIGURE 5 OMITTED]

[FIGURE 6 OMITTED]

6. CONCLUSION

The remote experiments constitute a new type of education. The main motivation of the project is design for laboratory with really models and with local and remote work for students. The project is finished; the selection the technical means is ended.

The main conclusions or news are:

--project designs really laboratory models with automatically regime through internet

--topology is opened and free

--project continues on works other people and expands the today results

--laboratory models are used as learning and as teaching purpose.

The realisation, development of software of project will begin in the next days.

7. REFERENCES

Lustig, F., Dvorak, J. (2004). ISES WEB CONTROL, software kit for remote laboratories using the ISES hardware. fl@plk.mff.cini.cz.

Smutny, L. at all. (2005). Support of E-learning in experimental laboratories. Proceedings of 6th International Carpathian Control Conference, pp. 155-160, ISBN 963 661 645 0, Miscolc, 5/2005, Miscolc, Hungary.

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