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Remote control of micro hydro electric-power station FIRST STEP for a computing management and energy optimizing in a hydro energetic plant

This paper proposes to realize a general solution for the remote control of a MHEPS; This solution has implemented at Cerna Hydropower plant which belong to Hidroelectrica Targu-Jiu.

It is necessary to administrate efficiently the hydro-energetic resources, decrease the cost of the energy and increase the running security.

The target of the paper is the control and supervising of water accumulations in the hydro-energetic plants, the remote control of the hydro-power plants and the development of the hydro-energetic fitting-out.:

- increase the energetic capacity optimizing the use of the energy in a micro hydro-power plant station.
- permanently and continuously information about the water debits in the hydro power plant.
- establish a MHEPS's optimum running rate for the entire year.
- eliminate the inundation risk during the autumn-winter season and winter-spring season increasing the system running safety
- increase the efficiency on the whole chain of energy producing and use and integrate the energetic sector in the EU standards.
- realize a complex automation for the remote control of the hydro-power plant stations.
- Realize a high technologic efficiency.

The system is un SCADA Decision Support System / Management Support System which lead to the efficient use of the energy, the optimum use of the water resources.

The system implemented, allows a real time analyzing of the measured parameters, the automatic control of the water debits, the automatic driving of the tilting gates, the finding-out of the damages and the transmitting of data.

Advantages:

- the efficient management of the hydro resources,
- low costs;
- running reliability;

- efficient control of the hydro electric power stations.

The domains involved in the Project:

- The production domain;
- The mechano-energetic domain
- Designing domain
- Projecting domain
- Informatic domain

The description of the thecnical solution:

The target is to implement a complex automation system for the remote control of the hydroelectric power stations.

From scientific point of view it is studied the following problems:

- realize an automation system for the remote control of the hydro electric power stations ;
- elaborate methods for up-date the hydroelectric power stations;
- elaborate the algorithms for the efficient running of the hydro power plants; The algorithms are based on the weather's prognosis and aim to allow a maximum energetic production and to prevent the inundations;
- realize a mathematic model of the technological installation;
- study and simulate the propagation of the freshet in the case of a forced flowing, the prognosis of the freshet evolution, elaborate the prognosis soft;
- will calculate the water's debit flowing toward the storage basins basing on the information provided by the transducers set in the storage basin;
- will calculated the period of time in which the upstream water's debit arrives in downstream storage basin.
- Will calculate the debit-out in the storage basin function of the opening and geometry of the tilting gate;
- Will calculate the opening of the tilting gates;
- Will calculate the control rules for the system;

The equipment's features for the remote control of the hydroelectric power stations:

- acquisition, real time processing of the input signals; processing of the information;
- automatic control to plant's equipments;
- optic signalization of the equipment state;
- local displaying and configuration, RS232 output to connect at programming equipment;
- RS485 output connecting with plant's network for the remote supervising of the parameters;
- data saving on the equipment's Hdd;
- possibility to access the real time data; off-line data analyze using data bases for a normal running/ damage; elaborate the graphic or numeric reports - local or remote.
- Connecting with automatic synchronization equipment; The synchronize equipment take the decision for parallel connecting of the hydro unit with the system;

The system realize the start/stop functions:

- Verify the starting conditions;
- Hydro unit starting - local/remote;
- The control bringing the motor's speed to synchronization speed;
- Storage battery coupling to the generator's terminals;
- Synchronization, the parallel coupling of asynchronous generator;
- The control made by operator or automatically;
- The stimulant loading of the asynchronous generator after its coupling to the system;
- Local or remote automatically stopping-damage/normal ;
- The control of the motor driving the mechanical limitation of the directing apparatus;
- The electro pump control to keep the nitrogen's pressure;

Fig 1: Interface operator;
Remote control

The system realizes the following protections:

- Maximal voltage protection with instantaneous effect;
- Maximal current protection with timing effect;
- Protection against away running with instantaneous effect;
- Protection against the motor rate running, with timing effect;

The equipment acquires, processes, and transmits to the central computer, the following information:

- The running rate of the hydro mechanic equipment -"Manually/Rest/Automatically";
- The key setting the hydromechanic equipment running has the position: local control/remote control;
- The supply is : basis source/ store source;
- The position of the supplying self -action switch: basis source/switched-in store source/released store source;
- If exist the command: Opening/Closing of tilting gates;
- The position of the motor supplying switch : left/right for opening/closing, is switched-in/ released;
- Supplying voltage-from basis source/store source, on the phase : R/S/T;
- The current consumed by the left/right motor on the phase: R/S/T;
- The tilting gate is on the sill;
- The position of the tilting gate: open/close;
- The electric break of the driving mechanism: left/right, supplied/ unsupplied, running/no running;

- The manually driving mechanism: left/right: connected/unconnected;
- The evacuated debit (is a effective value);
- The temperature into the control and supplying bloc (is a effective value);

The system allows the following signaling:

- If run the protection of the automatic switch supplying the equipments from: basis source/store source, the motor in left/right for opening/closing driving;
- Overloading left/right;
- Unloading left/right;
- PLC-damage;

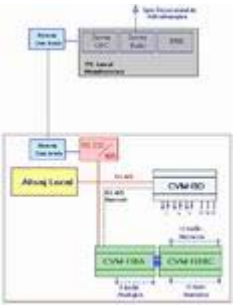

Fig 2. The system's structure

The formulas for calculation the water volume in the storage basins take into account:

- Models for the reconstituted debits;
- Affluent debits;
- The diagram of the lakes capacity;
- The mathematic models for the statistic calculation and analyze;
- The models for the debits and levels prognosis;

The advantages of the computing system in the hydro-electric power stations:

- The supervising equipments ease the user's activity, by a fast monitoring of the events;
- Allow an analyze for each equipment - running hours, consumed energy/ producd energy, etc.;
- The after-damage analyze is made efficiently and rapidly;
- The maintenance of the whole installation is made easier and low costs;
- The equipment allows a real time remote control of the plants;
- Increasing the availability of the hydro units, due to the rapidity with which an event is detected;
- Increasing the produced energy due to a high efficiency;
- The data are transmitted by Intranet;
- Decreasing the maintenance costs due to the automatic control equipments;
- Is an open system allowing the subsequent development and the other system interfacing.

The system aims the following effects: economic efficiency, good management, an optimal using of the resources, plants organizing, human problems, the failure impact to realize the system.