COMPUTER APPLICATION IN SMALL HYDRO POWER STATION

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Abstract: Small Hydro Power Station is both an efficient and reliable form of clean source of renewable energy. It can be an excellent method of harnessing renewable energy from small rivers and streams. The small hydro power station to be a run of river type, because it requires very little or no reservoir in order to power the turbine. The water will run straight through the turbine and back into the river or stream or river to use it for the other purpose. This has a minimal environmental impact on the local ecosystem.

In this research, we focus on Computer application in small hydro power station, concept of Automation in SHP, Control of operation and maintenance, components and benefits

Keywords: PLC, RTU, SCADA, HMI and Data server

Introduction

In the modern generation, computer application plays an important role in the field of knowledge. Many problems in different areas can be solved using computer applications. The application can model and analyse problems as well as design the solution and verify, comparing different techniques until identified the best one.

The automatic computer based system can be useful to control automatic starting, stopping safe operation and protection of generating equipment. Computer based automatic system have the ability to operate the hydro generating unit in a more efficient, accurate, safe and consistent manner.

Computer applications in renewable energy

Hydropower is one the most promising available energy sources in the world. The small hydro power station can be built in less and create less environment problems. The control of operation and maintenance system of small hydro power station have advanced in recent years. Small hydro power station were using hardwired relays for semi-automatic operation of turbine auxiliaries and a mechanical governor of speed control. With the development in computer technology.
Computers are widely used in hydropower stations for various controls. Controls of operation and maintenance systems should be simple, reliable, cheap, and with minimum interference of operating personnel. Control systems should be such that remote operation can also be performed easily.

**Automation concept in Small Hydro Power Station**

An automatic control system or automatic system is to allow the automatic starting, stopping, safe operation, and protection of any equipment being controlled through computerized control. An additional benefit of automation is the ability to operate the hydrogenerating unit in a more efficient manner. Computer-based automation improves hydro power plant operation and maintenance activities. Many activities previously accomplished by personnel can be performed more accurately and consistently by computer-based automation systems. Hydrogenerating units have been monitored and controlled by human operators for many years, both locally and remotely.

Computer-based automatic systems allow plant owners to operate and maintain their plants in better ways. Control algorithms based on criteria such as efficiency automatic generation control, and voltage control allow more cost-effective and safe operation of plants and interconnected power systems. Maintenance activities are improved by the computer’s ability to isolate problems, describe trends, keep reduced operation staff, consistent operating procedures, and the capability to have all control and data available for reference during normal and abnormal conditions.
There are two general classifications of systems used in hydropower plant automation systems. One class of systems uses proprietary hardware and software, and makes little or no provision for interoperation with other hardware and software. These are termed as closed systems. The other general system class is an integrated system, with all plant control and monitoring components having a common data communication structure supported by common hardware and software structure. The trend in these control systems is towards open systems. For contrast, a traditional supervisory control system is included to illustrate similarities and differences. Practically, it is seen that neither fully closed nor truly open systems exist. Rather, a spectrum of systems exists, all with some ability to communicate or function with other systems.

Control of operation and maintenance

A general control system for hydropower plants is defined in IEEE std 1010-1987. The combination of computer-based and non-computer-based equipment unitized for unit, plant, and system control should be arranged. The computer-based equipment may handle only automatic unit sequence and data acquisition, with all other functions, such as local manual control handled by non-computer-based equipment. Manual control equipment is also provided at the unit switchboard while in the local manual mode. During normal operation, the control and supervisory functions are carried out by computer-based equipment, and separate equipment is used for the protection functions.

Performance and reliability related components of hydropower plant instrument and control system are based on the automation design.
Components in Automation

- PLC (Programmable logic controller): The functions of a PLC is the heat of digital control system with programming capability that performs functions similar to relay logic system. PLC consists of a CPU (central processing unit), memory, power supply and means of communications to I/O and other devices.

- RTU (remote terminal unit): The functions of RTU is to collect data and it is similar to PLC. Sometimes, it may be termed as PLC, depending on the vendor terminology. RTU is generally associated with older control system with minimal control capabilities.

- HMI (human terminal unit): The functions of HMI is to be interface for the operator to the control system. The HMI is normally a PC as the client portion of client architecture.

- Data server: The functions of a data server is to link the controlled and the network to send data to the HMI and receive operator input from the HMI back to the controllers.

- SCADA (Supervisory control and data Acquisition): Over the decade, SCADA system, PLC based system and DCS (distribution control system) have migrated towards being synonymous.

  - Network LAN
  - Local control
  - Automatic control
  - Firewall
  - UPS
  - IDS
  - Historical Archive
  - Engineering Workstation
  - Efficiency optimization

Benefits of Automation system

- Hydro plants are started & stop more frequently
- Hydroelectric units also provide flexibility of changing the mode of operation for example, kW control, level control
- Provides successful, efficient and smooth operation.
- Plant are situated in remote areas with difficult to access
- Normally an automation system is implemented to improve the efficiency productivity and the operating management of the system. This automation will be better to the production needs and services
- Reduced in down time due to in diagnostics
- Reduced panel space
- Efficient utilization of manpower
- Reduction in Manpower
- Guide operator to optimize generation
- Reliable operation
- Lower cost

  An additional benefit of an automation system is the ability to operate the hydro generating unit in a more efficient manner.
Our energy demand continues to grow, while conventional resources are diminishing. Small hydro power stations are one of the most appropriate options to meet increasing energy demand, especially in a country like India. Hydro power generation is a significant renewable energy resource that can be used to cater to the demand. Computer-based control and automation has a number of advantages over other conventional types being used in SHP, such as lower cost, simple equipment while improving the efficiency, reliability and safety of their system.

**Conclusion:** Small hydro power plants are a vital source to the world. The automation process is reliable as per the maintenance, which should be done frequently. The use, the creation and expansion of small hydro power systems should continue being pursued.