



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

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

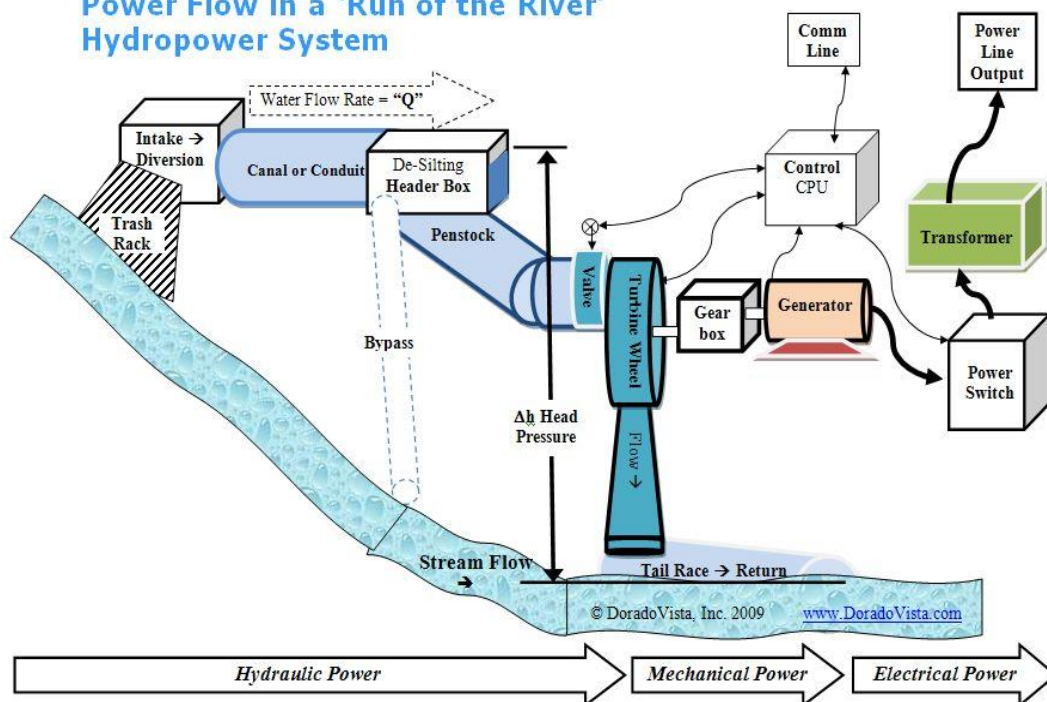
In the modern generation, computer application plays an important role in the field of knowledge. Many problems in different areas can be solved using computer applications. The application can model and analyse problems as well as design the solution and verify, comparing different techniques until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

Power Flow in a 'Run of the River' Hydropower System

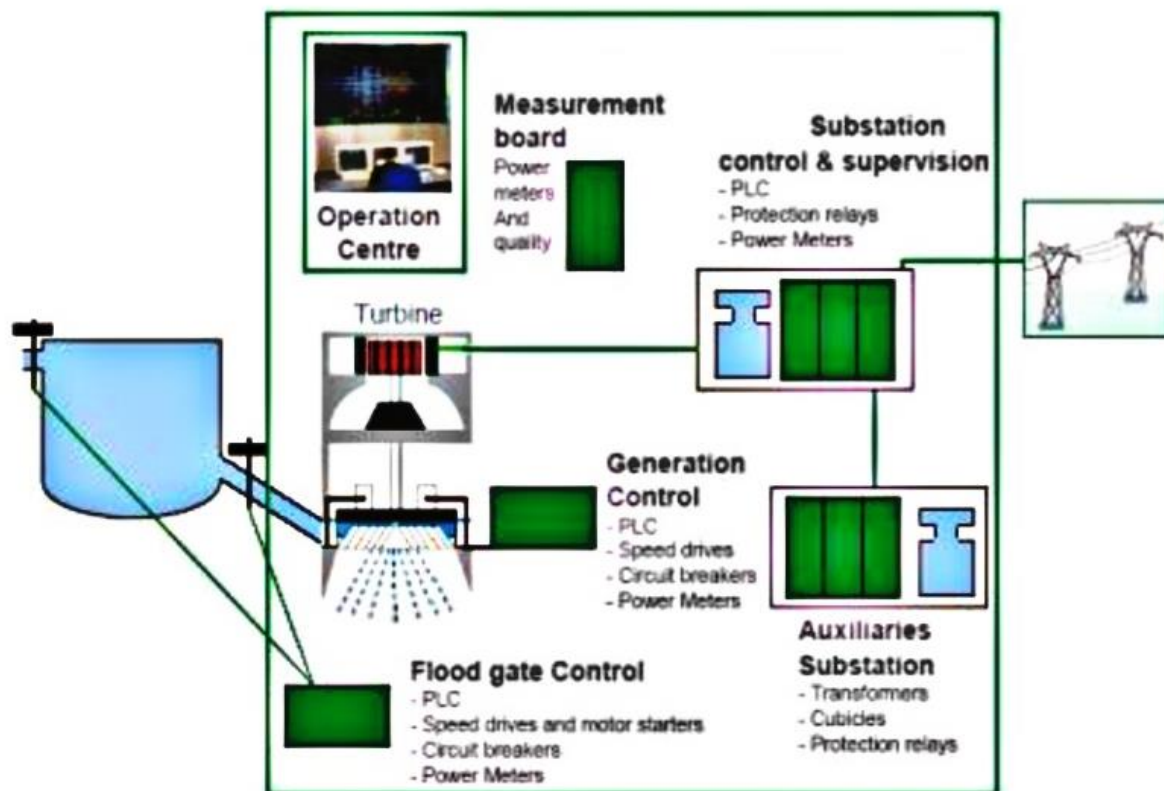


Computers are widely use in hydropower station for various controls. Controls of operation and maintenance system SHP should be simple, reliable, cheap and with minimum interference of operating personal. Control system should be such that remote operation can also be performed easily.

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 an automation is the ability to operate the hydro generating unit in more efficient manner. Computer based automation improves hydro power plant operation and maintenance activities. Many activities previously accomplished by plant personnel can be performed more accurate safely, and consistently by computer based automation system. Hydro generating units have been monitoring and controlled by human operators for many years, both locally and remotely.

Computer based automatic system allows plant owner to operate and maintain their plants in better ways. Control algorithm based on criteria such as efficiency automatic generation control, and voltage control allow more cost effective and safe operation of plants and interconnected power system. Maintenance activities are improved by the computer's ability to isolate problem, describe trends and keep reduced operation staff, consistent operating procedures and the capability to have all control and data available for reference during normal and abnormal conditions



Automation system in Small hydro power station

There are two general classification of system used in hydropower plant automation system. One class of system uses proprietary hardware and software, and makes little or no provision for interoperability with other hardware and software. These are termed as closed system. The other general system class is an integrated system, with all plant control and monitoring components having a common data communication structure support by common hardware and software structure. The trend in these control system is towards open system. 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 system exist. Rather, spectrum of system exist, all with some ability to communicate or function with other system

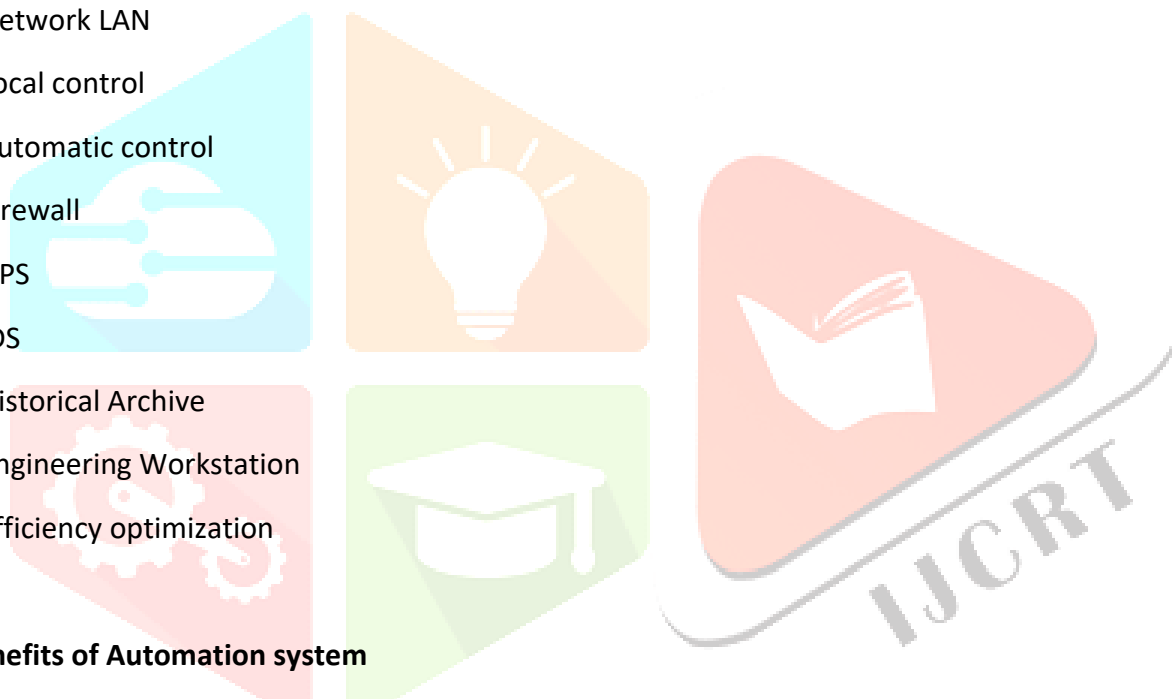
Control of operation and maintenance

A general control system for hydro power plant 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 handle by non computer based equipment manual control equipment. general, manual control are installed adjacent to the device being controlled, such as pump, compressor, valves and motor control centre. Often capability to operate individual items of 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 heart 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 device
- 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 continue to grow, while conventional resources are diminishing. Small hydro power station is one 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 advantage 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 Hydropower 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 system should continue being pursued.

