Matlab And Ardiuno Based Hydro Electric Dam Control with Overflow Gate and Water Level Control with Turbine Status.

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Abstract: ***Water and energy are essential elements of humanity's life and civilization and hydro power relates to both,it contributes to harnessing water flow in hydrological or river system thus alleviating floods and droughts and it allows sustainable and clean power production and distribution which is easily adoptable to changing demands.It has ecological effect to be considered as well.One of the most important issue in hydro power industry is to determine the necessary degree of automation in order to improve the operation security. Depending upon the complexity of the system (the power plant equipment) the automation specialist will build a philosophy of control following some general principals of security and operation. Helped by the modern digital equipment, today is relative easy to design a complete monitoring and supervising system including all the subparts of a hydro aggregate. A series of sensors and transducers specific for each auxiliary installation of the turbine and generator will be provided, together with a PLC or an industrial PC that will run an application software for implementing the security and control algorithms. The purpose of this project is to offer a general view of these issues, providing a view of designing an automation & control for hydro power plants of small, medium and big power.An automatic computer based system can be useful to control the automatic starting, stopping, safe operation and protection the generating equipment. Computer based automation system have the ability to operate the hydro generating unit in a more efficient, accurate, safe and consistent manner. The project is aimed to describe the various computer based control techniques and monitoring which can be able to enhance efficiency of the system at reduced costs.***

Index terms-MATLAB, Ardiuno, hydroelectric power generation, tachometer.

I. INTRODUCTION

It is a form of energy … a renewable resource. Hydropower provides about 96 percent of the renewable energy in the United States. Other renewable resources include geothermal, wave power, tidal power, wind power, and solar power. Hydroelectric power plants do not use up resources to create electricity nor do they pollute the air, land, or water, as other power plants may. Hydroelectric power has played an important part in the development of this Nation's electric power industry. Both small and large hydroelectric power developments were instrumental in the early expansion of the electric power industry.Hydroelectric power comes from flowing water … winter and spring runoff from mountain streams and clear lakes. Water, when it is falling by the force of gravity, can be used to turn turbines and generators that produce electricity.

II.METHODOLOGY

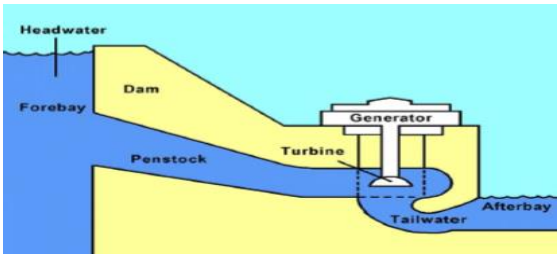


Fig 1.Hydroelectric power generation

Hydroelectric power comes from water at work, water in motion. It can be seen as a form of solar energy, as the sun powers the hydrologic cycle which gives the earth its water. In the hydrologic cycle, atmospheric water reaches the earth=s surface as precipitation. Some of this water evaporates, but much of it either percolates into the soil or becomes surface runoff. Water from rain and melting snow eventually reaches ponds, lakes, reservoirs, or oceans where evaporation is constantly occurring. To generate electricity, water must be in motion. This is kinetic (moving) energy. When flowing water turns blades in a turbine, the form is changed to mechanical (machine) energy. The turbine turns the generator rotor which then converts this mechanical energy into another energy form -- electricity. Since water is the initial source of energy, we call this hydroelectric power or hydropower for short. At facilities called hydroelectric power plants, hydropower is generated. Some power plants are located on rivers, streams, and canals, but for a reliable water supply, dams are needed. Dams store water for later release for such purposes as irrigation, domestic and industrial use, and power generation. The reservoir acts much like a battery, storing water to be released as needed to generate power. The dam creates Ahead or height from which water flows. A pipe (penstock) carries the water from the reservoir to the turbine. The fast-moving water pushes the turbine blades, something like a pinwheel in the wind. The waters force on the turbine blades turns the rotor, the moving part of the electric generator. When coils of wire on the rotor sweep past the generator=s stationary coil (stator), electricity is produced. This concept was discovered by Michael Faraday in 1831 when he found that electricity could be generated by rotating magnets within copper coils. When the water has completed its task, it flows on unchanged to serve other needs.

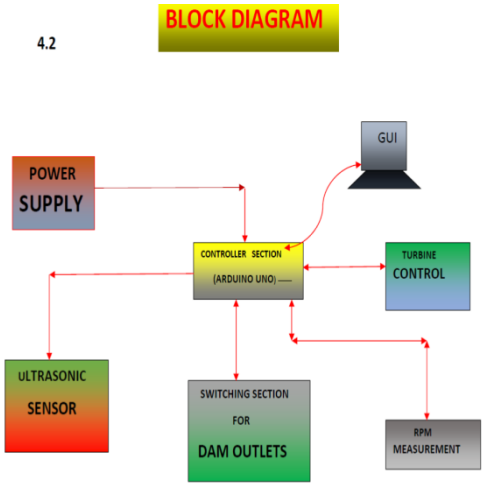


Fig 2.Block diagram of overall project

III.OBJECTIVES OF THE STUDY

Ultrasonic level instruments operate on the basic principle of using sound waves to determine liquid/ solid/slurries level. In addition to standard level or volume measurement, they can monitor open channel flow, determine the actual volumetric throughput in lift stations, measure differential level and control the pumps. In this design, the level sensor is located at the top in such a way that it sends out the sound waves in the form of bursts in downward direction to the water in the dam location under level measurement. As soon as the directed sound waves hits the surface of the fluid, sound echoes gets reflected and returned back to the sensor. Depending on the level of water dam gates are opened so as to avoid water overflow during heavy rains Tachometer is used here to continuously monitor the turbine status whether the turbine is moving or not. Data is shown on mat lab serial monitor us Continuous process monitoring in gaseous, liquid or molten media is a fundamental requirement for process control. Besides temperature and pressure other process parameters such as level, flow, concentration and conversion are of special interest. More qualified information obtained from new or better sensors can significantly enhance the process quality and

thereby product properties. Ultrasonic sensors or sensor systems can contribute to this development ing serial communication as a medium. Continuous process monitoring in gaseous, liquid or molten media is a fundamental requirement for process control. Besides temperature and pressure other process parameters such as level, flow, concentration and conversion are of special interest. More qualified information obtained from new or better sensors can significantly enhance the process quality and thereby product properties. Ultrasonic sensors or sensor systems can contribute to this development.

3.1 Ultrasonic Sensor(HC-SR04)

Fig 3.Ultrasonic sensor

Ultrasonic transducers are transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers; many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and transmit. These devices work on a principle similar to that of transducers used in radar and sonar systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively.

Arduino Uno:

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

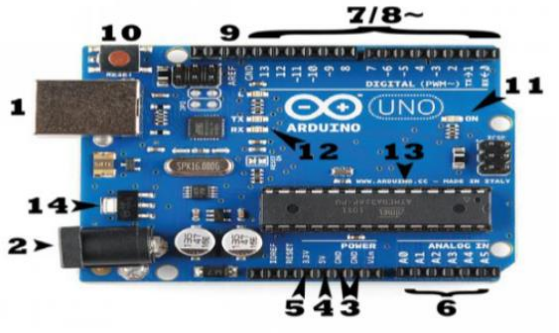


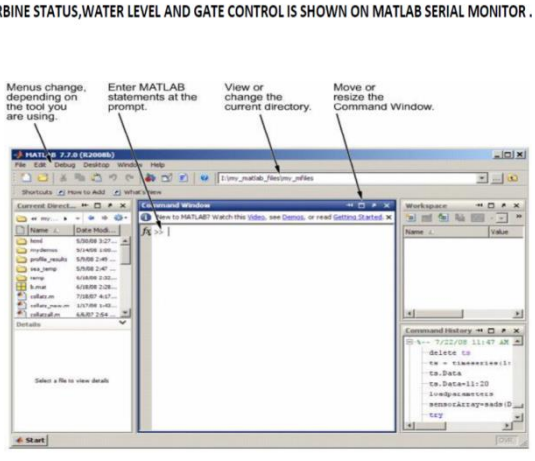
Fig 4.Arduino Uno

Tachometer:

A tachometer (revolution-counter, tach, rev-counter, RPM gauge) is an instrument measuring the rotation speed of a shaft or disk, as in a motor or other machine.[1] The device usually displays the revolutions per minute (RPM) on a calibrated analogue dial, but digital displays are increasingly common.Here tachometer is used to monitor the turbine status.

Fig 5.Techometer

TURBINE STATUS,WATER LEVEL AND GATE CONTROL IS SHOWN ON MATLAB SERIAL MONITOR .



3.2 Equipments Required For The Project:

Arduino UNO/ ULTRASONIC SENSOR(HC-SR04) LCD display (16*2)Transformer/BridgeRectifier/buzzer, tachometer

3.3 Expeted Contribution From The Study:

Ultrasonic sensors detect almost all materials. Liquids like milk, chemicals, or lacquer, as well as mud or bulk goods are safely controlled. They accurately monitor the fill level of silos or tanks used by dairies, chemical plants, mineral companies, and many others. Also ultrasonic sensor contributes to measurement of liquid level without contact at the places where human interaction with toxic chemicals as these are harmful for human.

3.4 Arduino Uno

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package. Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.The Uno is one of the more popular boards in the Arduino family and a great choice for the beginners.

IV.DESIGN BASED ON SOFTWARE

4.1 Introduction to Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

4.2 HOW TO WORK WITH ARDUINO

Connect your Arduino to the computer with the USB cable. You do not need the battery for now. The green PWR LED will light. If there was already a program burned into the Arduino, it will run. Start the Arduino development environment. In Arduino-speak, programs are called “sketches”, but here we will just call them programs.

Reset	3v3	5v	Gnd	Vin	Analog In	RX/TX	Digital	PWM(~)	AREF
Resets Arduino sketch on board	3.3 volts in and out	5 volts in and out	Ground	Voltage in for sources over 7V (9V-12V)	Analog inputs, can also be used as Digital	Serial comm. Receive and Transmit	Input or output, HIGH or LOW	Digital pins with output option of PWM	External reference voltage used for analog

Table 1. Arduino configuration.

Fig 6. Arduino sketch

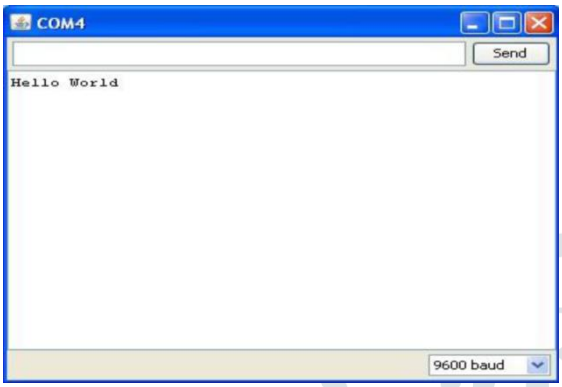


Fig 7 . Final result

4.3 STARTING MATLAB, MATLAB WINDOW

It is assumed that the software is installed on the computer, and that the user can start the program. Once the program starts, the MATLAB desktop window opens (Figure 1-1). The window contains four smaller windows: the Command Window, the Current Folder Window, the Workspace Window, and the Command History Window. This is the default view that shows four of the various windows of MATLAB. A list of several windows and their purpose is given in Table 1-1. The Start button on the lower left side can be used to access MATLAB tools and features. Four of the windows—the Command Window, the Figure Window, the Editor Window, and the Help Window—are used extensively throughout the book and are briefly described on the following pages. More detailed descriptions are included in the chapters where they are used. The Command History Window, Current Folder Window, and the Workspace Window are described in Sections 1.2, 1.8.4, and 4.1, respectively.

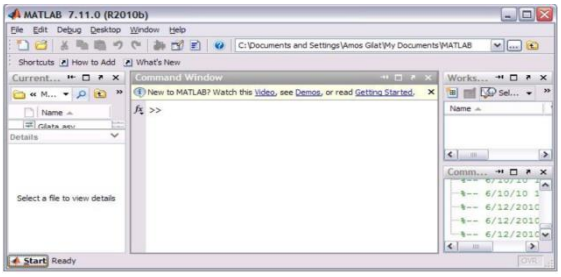


Fig 8. The default view of MATLAB desktop.

CONCLUSIONS

Our energy demand continues to grow, while conventional resources are diminishing. hydropower (HP) is 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. The conventional methods for plant control may be uneconomical, if applied to HP due to high cost, so integrated automation and control has become the solution for making it efficient and cost effective. Computer based control and automation has a number of advantages over other conventional types being used in HP such as lower cost, simple operation and maintenance, operators can extend the serviceable life of their equipment while improving the efficiency, reliability, and safety of their systems.

FUTURE SCOPE

The main purposes of modern automatic control systems in hydro power plants are: - Automatic control of speed (frequency) and/or output of the power group, known as automatic speed control systems (SRAV). –Automatic control of generator voltage, known as automatic control of excitation systems (SRAE). - Control of water level in the storage reservoir and of the swirling flow, depending on the plant requirements. Protection of hydropower group to failures and defects, either on the electric part or on the hydraulic part. These main purposes are the same as 100 years ago. But, the development of digital systems currently allows implementation of additional functions to the control systems of the hydro power plants in order to increase the efficiency in operating the hydropower resources and power generation. Among these additional

functions are mentioned.Optimization of the entire system to ensure high availability and efficiency of the hydropower group in order to decrease the costs of power generation.Long-term optimization of hydro power plants assemblies operating on the same stream in order to obtain maximum power generation.Overall control of power plant equipment and monitoring of operation from a local or central dispatcher.Automatically start-up/shut-down by remote control and choosing the optimal number of units in operation. The structure and functions of the driving systems depend on a number of factors such as: type of the power plants, net heads, swirling flows, types of turbines, output of power groups and their classification in the hydro power plant and energy system. It is impossible to provide a unitary structure of these systems.

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