SMART DAM MONITORING SYSTEM WITH ELECTRICITY GENERATION, MUD SEPARATION & WATER FILTRATION

Prof. R. J. Nikam[1], Dipali Ashok Sawale[2], Shalinee Shivprasad Pardeshi[3], Vaishnavi Sunil Gangurde[4], Swanand Vilas Shinde[5]

[1]*Proffsor, Electrical Department, MET's Institute of Engineering, Maharashtra, India*
[2]*Student, Electrical Department, MET's Institute of Engineering, Maharashtra, India*
[3]*Student, Electrical Department, MET's Institute of Engineering, Maharashtra, India*
[4]*Student, Electrical Department, MET's Institute of Engineering, Maharashtra, India*
[5]*Student, Electrical Department, MET's Institute of Engineering, Maharashtra, India*

ABSTRACT

As we know the population of India is increasing day by day and due to this there is more need and need for electricity generation. In 2009, the three most heavily used sources for generating electricity were coal, natural gas and oil. These sources not only release emissions that are harmful to the environment, they are resources that are quickly running out. Therefore, different ways of generating power will need to be explored. Hydroelectric power generation is one of the best ways in which electricity can be generated, The most common type of hydroelectric power plant is an impoundment facility. An impoundment facility, typically a large hydropower system, uses a dam to store river water in a reservoir. Water released flows through a turbine, spinning it, which in turn activates a generator to produce electricity. The hydropower plant from dam water faces challenges related to the effective filtration of mud and sediment in the water, impacting both the efficiency of power generation and the environment. To overcome this problem Mud Filtration Mechanism is very helpful which helps to separate the settled layered of mud from the dam water which is further uses in agricultural sector.

Keyword: - *Dam Monitoring, Mud Separation, Water Filtration, Hydropower, Automation, Arduino*

1. INTRODUCTION

Hydroelectric power, also called hydropower, is electricity produced by generators driven by turbines that convert the potential energy of falling or fast-flowing water into mechanical energy. In the early 21st century, hydroelectric power was the most widely utilized form of renewable energy; in 2019 it accounted for more than 18 percent of the world's total power generation capacity. In the generation of hydroelectric power, water is collected or stored at a higher elevation and led downward through large pipes or tunnels (penstocks) to a lower elevation; the difference in these two elevations is known as the head. At the end of its passage down the pipes, the falling water causes turbines to rotate.

The turbines in turn drive generators, which convert the turbines' mechanical energy into electricity. Transformers are then used to convert the alternating voltage suitable for the generators to a higher voltage suitable for long-distance transmission. The structure that houses the turbines and generators, and into which the pipes or penstocks feed, is called the powerhouse. Hydroelectric power plants are usually located in dams that impound rivers, thereby raising the level of the water behind the dam and creating as high a head as is feasible. The potential power that can be derived from a volume of water is directly proportional to the working head so a high-head installation requires a smaller volume of water than a low-head installation to produce an equal amount of power. In some dams, the powerhouse is constructed on one flank of the dam, part of the dam being used as a spillway over which excess water is discharged in times of flood. Where the river flows in a narrow steep gorge, the powerhouse may be located within the dam itself.

2. LITERATURE SURVEY

[1]Mohammad Mehedi Hasan et al. (2018) have studied the impact of climate change on hydropower generation in Rio Ju bones Basin, Ecuador. It was stated Hydropower plants with low storage capacities are more susceptible to climate change, as a high storage capacity requires more workability to operate. In this study, wind speed, relative humidity, and solar radiation data were derived from the monthly statistics of weather information for which seven rain gauge stations and three temperature stations were utilized. It was found hydropower generation will be increased in the wet season and plants will face a significant power shortage during the dry season

[2]. Marco Casini (2015) has studied harvesting energy from in-pipe hydro systems at urban and building scales. It was found that in-pipe hydro systems can be operated on various head and flow conditions. He further classified them into two designs. Internal systems, where the runner is wholly inside the pipe section and only the generator protrudes from the conduit, and External systems, where the runner is contained in a secondary conduit that bypasses the main one.

[3].Binnie, Kimber, M. Basic Water Treatment, 5th ed.; ICE Publishing: London, UK, 2013 Absolutely pure water is never found in nature and it is increasingly rare to encounter a source of water that requires no treatment before being used for potable water supply. Water contains both biological and inorganic matter. The matter found in water is affected by: the source of the water, impacted by the geology of the route taken from rainfall to point of extraction; vegetation and animal impacts; and human impacts, reflecting activities such as the application of agricultural chemicals and waste discharges. It is normal to classify the impurities found in water in one of three progressively finer states– suspended, colloidal, and dissolved. The method of treatment required for the removal of impurities, or their reduction to acceptable limits, depends in part on the fineness of the material.

[4]. Shabiimam M.A., Conference: NICMAR 3rd International Conference On Construction, Real Estate, Infrastructure, and Project (CRIP) Management.

In view of all the above parameters, this review study is to discuss about the various filtration techniques available. Natural substitutes used as a filtering medium which are less expensive or which may be a by-product of any agricultural or manufacturing process.

3. NEED OF PROJECT

The challenges that the Dam & Hydropower Plant faces due to sediment settling at the bottom of the dam reservoir, are as follows:-

- Reduced reservoir capacity
- Decreased efficiency of turbine
- Increase maintenance costs
- Potential environment impact Such as habitat, alteration and water quality issues.

4. OBJECTIVES OF PROJECT

The aim of the hydropower plant with dam water and mud separation is to harness renewable energy from water stored in a dam while implementing an efficient mud separation system. The overall goal is to generate clean and sustainable electricity while minimizing environmental impact and optimizing the performance of the hydropower system

5. DESIGN & IMPLEMENTATION

Designing a smart dam monitoring system involves integrating advanced technologies and methodologies to ensure efficient, reliable, and proactive monitoring of dam infrastructure. Below are key elements and consideration for designing a smart dam monitoring system.

Designed smart dam monitoring system should be adaptive, resilient, and capable of providing actionable insights to support proactive decision-making, enhance safety, and optimize dam operations and maintenance. Collaboration among engineering experts, data scientists, IT professionals, and stakeholders is essential to successfully design, implement, and maintain a smart dam monitoring solution.

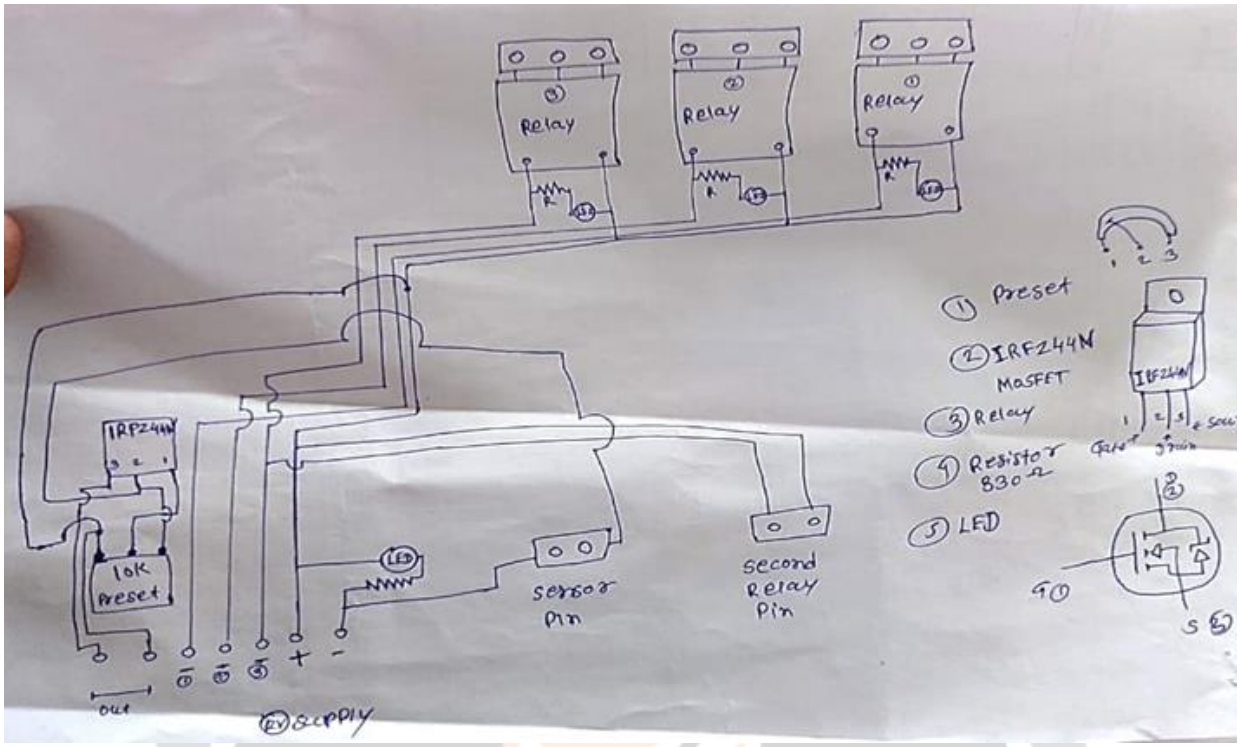

Fig -1: Connection Diagram of System

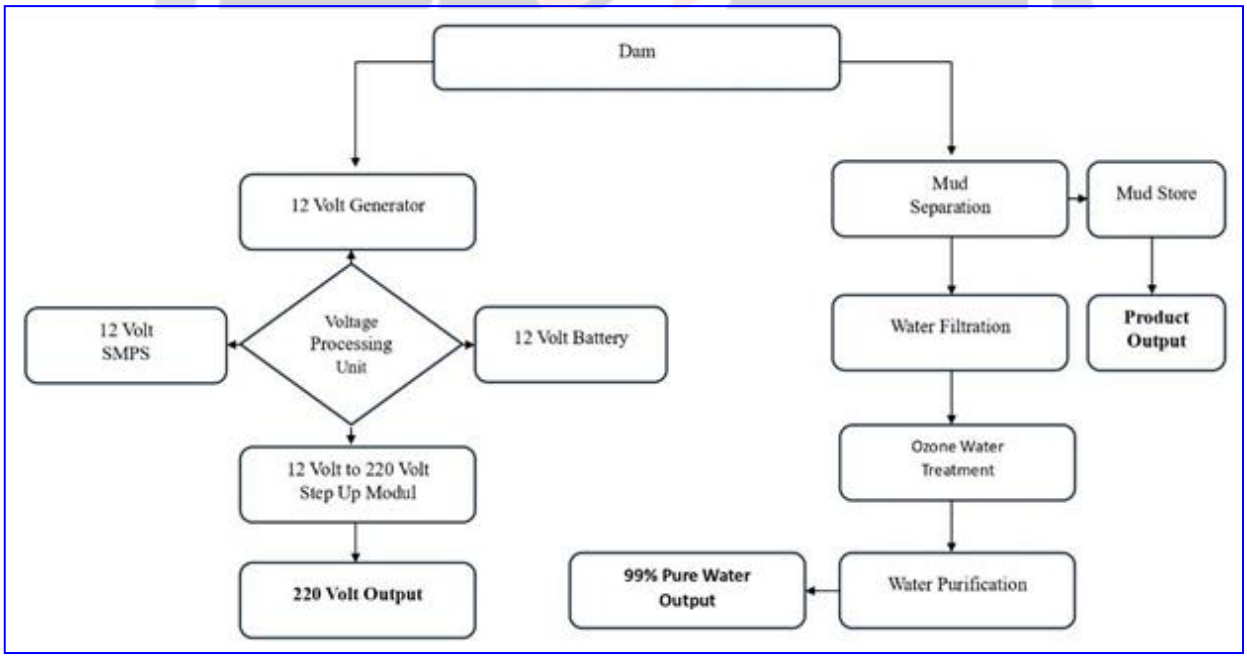

Fig -2: System Flowchart

5.1 Water filtration and water treatment explanation

A useful method has been used to remove silt from the dam A device has been installed at a distance of 500 meters from the dam gate which works to remove soil and silt waste from the dam. Whatever material is extracted from the dam is sent to the Next Step for a specific process. The material that has been removed from the water is then processed and separated into soil sediment and waste in that water, which is done in three stages. And the soil is deposited in one tank as well as the silt is also deposited in another tank and the waste is also deposited in a specific

tank. And whatever water is left is swallowed and sent forward. And that water is filtered, and then the water is sent back to the Next Step. And that water is treated with water, which works to kill germs in that water purifies the water and makes the water potable.

Water pump: The water pump, with the help of special machinery, works to remove silt soil, and waste from the dam and also to remove the water from the dam, but in this mixed water, the soil and waste are of the contaminated type. These pumps remove the silt from the bottom of the dam and process it with the help of a system to purify it. A water pump is a very large full motor that removes all the material, while the voltage required for this water pump motor is 12 volts.

Gear motor (rotary motor): A rotary motor works to mix the sludge pressed into the ground in the water with the water, as well as the work of throwing sludge into the mouth of the water pump, which helps the water pump to remove the silt, soil, and waste from the water. And it can easily be pulled out of the dam. A rotary motor works to mix soil and silt in water.

Air Compressor: The air compressor helps to remove silt and soil from the dam. At very high pressure, the machine installed in the dam is air compressed and released into the dam, due to which the sludge pressed under the water of the dam acts as a free work to the soil and debris. And immediately the water pump takes all that material out of the water.

The motherboard: It is equipped with a four-reel module that is connected to a sensor in the water. The sensor takes input, and as an output, the relay acts as a motor on or off. If the sediment level in the water increases too much, the sensor is immediately understood and the sensor gives the input that the level of help in the dam has increased, so the system in the water starts immediately and the work of removing the sediment and debris from the water starts. It also serves to show how full the water in the dam. The motherboard also works to separate the soil and waste extracted from the water, the sediment is deposited in one tank and the soil in the second tank, and the waste in the third tank. After that, whatever water is left is filtered. And that filter water is sent to the Next Step and then that water is treated so that the microbes in the water are killed and the water becomes potable. The water that has become potable can be sold to the Metropolitan Municipality.

5.2 Voltage Generator Explanation

When this flower in the dam is full, the gate of the dam is opened and the power generation system in this project generates 12 volts of electricity and you give that 12 voltage step up which is increased from 12 voltage to 220 voltage. And 12 voltages are stored in lithium-ion Batteries. And when the gates of the dam are not open, the battery voltage is taken and the voltage step up is produced from 12 volts to 220 volts. The project also takes power from a total of three systems and works on it, but to run this project, there is only one energy medium that the motherboard holds that under what circumstances any energy should be taken. To run the project, the water generator is turned off at that time and when the water generator is working to generate electricity, the battery is also charged. The central unit, also known as the motherboard, is the brain of this project and works to process and control all kinds of tasks. Output products that can be sold to the Metropolitan Municipality to sell products that come out of this system.

Voltage generated from the dam: The energy voltage generated from this project is non-renewable energy, and because of that, this voltage can be used in metropolitan municipalities or villages where there is a shortage of electricity, and at the same time, electricity can be sold to a private company.

Soil or silt removed from the dam: The soil or silt in the dam is very fertile, the sediment is very high in organic matter, due to which the soil is very useful for agriculture. The finished soil can also be sold for farming business.

Filtered water: The filtered water in the dam is potable, so this water can be sold to the Municipal Corporation or the filtered water of this dam can be given to the villages which are short of water.

6. RESULTS

Fig -3: Hardware Implementation of Prototype

Fig -4: Hardware Implementation of Prototype

7. APPLICATIONS

- Electricity Generation system.
- Water Filtration system.
- Mud sells to agriculture.
- Fish Escape and Fish life safely.
- Dam in the ground side clean system.
- Store large amounts of Water.

8. OUTCOMES

- Enhancing dam safety.
- Improving sustainability.
- Enhancing water quality.
- Increasing operational efficiency.
- Minimizing environmental impact.
- Improved overall efficiency of dam.

9. CONCLUSION

The implementation of multi-filtration in the dam water and hydropower plant project proves to be a crucial step toward optimizing both water quality and energy production. By employing advanced filtration techniques, the project not only enhances the efficiency and longevity of the hydropower system but also emphasizes environmental stewardship through the protection of the aquatic ecosystem. This approach showcases a sustainable model for water management and clean energy generation, setting a positive precedent for future projects seeking to balance energy needs with ecological responsibility.

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