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Design and Implementation of Power Consumption through Waste Water Using Pelton Turbine

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ABSTRACT-The project is based on the production of electricity in wastewater using a Pelton turbine engine. Wastewater can be treated to different qualities to meet demand from different sectors, including industry and agriculture. It can be processed in ways that support the environment and can even be reused as an electric city. So we assume that the project produces electricity using waste water, saving money and electricity. So, considering the importance of generated electricity through renewable methods, we will design and manufacture a system it will generate electricity using an Pelton wheel turbine. For a multi-storage building where we supply water for different floors from the top of the building. With the downward force of the water, we attach the assembly containing an Pelton wheel turbine and alternator use to generate electricity. Generate Dynamo Pelton Turbine Engine. The hydro motor and Pelton turbine are connected to the relay, then the relay is turned on to high voltage, and the second motor is turned off, and the running motor generates electricity to connect the charging circuit, the circuit stores electricity in the battery. And to the water flow motor and the Pelton turbine motor connected to the voltage and current sensor, the information is sent to the microcontroller, which displays the value of the voltage and current sensor on the LCD display.

I. INTRODUCTION

In this project, we use the gravitational force of water to drive a Pelton turbine, which is connected to an electric generator to produce electricity. Several different types of turbines are used to generate hydropower. Among them, the Pelton turbine is used in places with medium to high gradient. Energy from running water has been used since time immemorial to meet some energy requirements. The oil embargo of 1972 triggered the search for alternative energy sources. Small hydropower, which has so far given way to the development of medium and large hydro projects, has attracted more attention than any other renewable energy source. In essence, due to the versatility and convenience of electric power on the one hand and the cheapness and renewable nature of hydropower on the other, small hydropower plays a definite role in today's energy scene. The concept of generating electricity from water has been around for a long time and there are many large hydroelectric plants around the world. What is new to most people is the idea that the same concept will work on a smaller.

II. OBJECTIVE

- In our project setup, we conclude that we get free electricity using an inline Pelton wheel turbine. Here we will not provide any additional sources of electricity generation. So our project is economical and cost effective.
- Water cycles like nature and turbine power plant help generate electricity. Therefore, we will propose the layout of a micro hydroelectric power plant for electricity production. The system is a configurable power source that can be used to generate alternating current even in remote locations. Then the Pelton turbine generator system uses the wastewater to convert electricity. Also for desirable implementation and development of Pelton turbine generator system, the design of turbines and electrical power generator must be considered.



III. LITERATURE REVIEW

1. Emanuele Quadrant, Roberto Revelli, "Gravity water wheels as a source of micro hydropower", 2020. In essence, due to the versatility and convenience of electric power on the one hand and the cheapness and renewable nature of hydropower on the other, small hydropower plays a definite role in today's energy scene. The concept of generating electricity from water has been around for a long time and there are many large hydroelectric plants around the world. What is new to most people is the idea that the same concept will work on a smaller – and even individual – scale. 2. M.F. Basar, A. Ahmad, N. Hasim, "Pelton turbine power generation system. Latest trends in renewable energy and environmental informatics", 2019. Today, a sustainable source of electricity is necessary not only to ensure the necessary economic development, but also to maintain environmental management in our society. Renewable energy sources can help countries meet these requirements. The importance of renewable energy for sustaining electricity production in relation to its ability to contribute to the mitigation of electricity supply needs in rural areas is highly relevant. 3. V.L. Streeter and E.B. Vylie, "Hydro pulse Turbine Development and New Opportunities", 2021. The Pelton turbine (or Pelton wheel) is among the most efficient impulse turbines and has maintained its existence in hydroelectric power for more than a century since its invention by Lester A. It will show that the high gain parameters of the P and D controller used to limit turbine over speeds cause instability of the swing mode. As a result, a modified deflector controller is designed consisting of a PI controller with reduced gain parameters and all adaptive forward controls def. sign to initiate rapid deflector action in overspeed conditions.

IV. EXISTING SYSTEM

Large hydropower outages due to damage to the hydroelectric plant connections. It shuts down from time to time for minor glitches before each generation and can usually be restarted after the glitch is fixed. Various protections are built into the stations to cause shutdown before more damage occurs. Some hydroelectric failures can go beyond the immediate loss of generating capacity, including destruction of the turbine itself, reservoir disruption, and significant destruction of downstream national grid infrastructure. In some cases, their correction can take years.

DISADVANTAGES

- Requires a high head to operate. Turbine size is generally large.
- Its effectiveness decreases rapidly over time. Due to the high delivery height, it is very difficult to control the operating head deviations.

V. PROPOSED SYSTEM

The Pelton turbine energy system is used to generate electricity using waste water, it can be produced cleanly using completely renewable methods. The process of generating electricity is working with water power, as when a hydro motor converts water power into electricity. The output of the rectifier is fed to the inverter to obtain a high-frequency alternating current source. Energy production using waste water is a proven method. Then the hydro motor and the Pelton turbine motor are connected to the voltage current sensor, the sensor will send the percentage of electricity on the display. The hydro motor and Pelton turbine connect to the relay, then the relay turns on the high-power motor and the other motor turns off, and the running motor generates electricity to connect the charging circuit, the circuit stores the electricity in the battery. Battery works together in DC-DC booster and linear regulation voltage, regulation voltage maintains a constant voltage. Microcontroller Nano receives power and produces an AC bulb or other home appliances

ADVANTAGE

- This project involves the improvement of green technology using renewable energy such as wastewater. It is also intended to help remote communities get electricity with low installation costs using green technology.
- This system will invest less installation cost without dam or reservoir.
- It also requires lower maintenance and replacement costs while being environmentally friendly for long-term use.



VI.SYSTEM FUCTION

1. BLOCK DIAGRAM

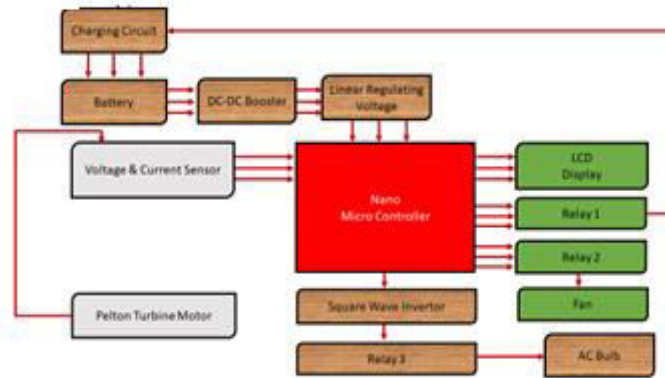


Fig.no:1 Block diagram for proposed system

2. BLOCK DIAGRAM EXPLANATION

6V of battery power supply is given to DC-DC booster which will increase voltage. Power supply is given to linear regulation voltage; here 5V of constant power supply is given to Nano-microcontroller. Nano-microcontroller will be responsible for transferring information and getting information from other devices through analog to digital signal conversion. Once pelton turbine motor runs, voltage and current are produced. Through voltage and current sensor, we can know how much voltage and current are produced. This voltage and current sensor will send information to Nano-microcontroller and on the LCD display, we can see voltage and current produced by pelton turbine rotation. The relay will get activated to send maximum amount of voltage to charging circuit. Once after receiving voltage, the charging circuit gives power supply to battery to store power supply in battery. Nano-microcontroller will give instructions to square wave inverters to convert AC-DC power supply and also power supply will be increased with help of DC-DC booster. Increased power supply will be 230V. Relay 3 will get ON and 230V bulb will get ON.

3.CIRCUIT DIAGRAM

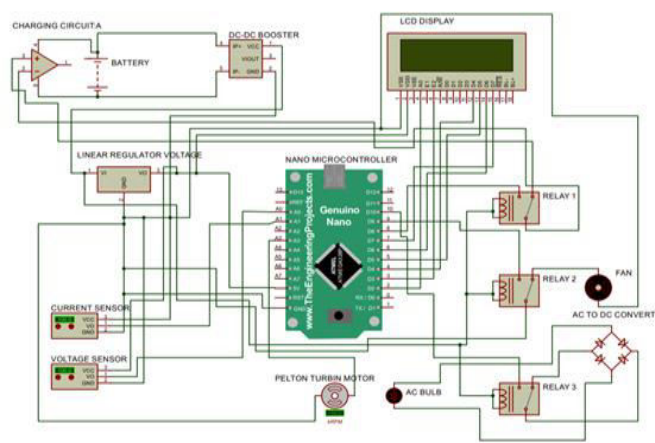


Fig.no:2 Circuit Diagram

4. Circuit diagram explanation

- 6V of battery power is fed to a DC-DC booster to increase the voltage. Power supply is given by linear regulation voltage, here 5V constant power supply is given to nano-microcontroller.
- A nano-microcontroller is responsible for transmitting information and retrieving information from other devices through analog to digital signal conversion.
- Once the voltage and current of the Pelton turbine motor is established. Through voltage and current sensor, we can know how much voltage and current was produced. This voltage and current sensor will send information to the Nano-



microcontroller and we can see the voltage and current produced by the rotation of the Pelton turbine on the LCD display.

- The relay activates to send the maximum amount of voltage to the charging circuit. Once after receiving the voltage, the charging circuit supplies the battery to store the energy in the battery.
- The nano microcontroller will instruct the rectangular inverter to convert the AC-DC power supply and also the power supply will be boosted by the DC-DC booster. The increased power supply will be 230 voltages.
- Relay 3 closes and the 230V bulb lights up.

VII. HARDWARE REQUIREMENT

1. NANO MICROCONTROLLER

Nano microcontroller

The Nano board is designed to make it very easy for beginners to get started with microcontrollers. This board is particularly board friendly and very easy to handle. Let's start by powering the board.

Powering You Nano:

USB connector: Connect the mini USB connector to your phone charger or computer with a cable and it will draw the power needed for the board to work properly

Vin Pin: The Vin pin can be powered by an unregulated 6-12V to power the board. The on-board voltage regulator regulates it to +5V

+5V pin: If you have a regulated +5V supply, you can directly provide it on the +5V pin.

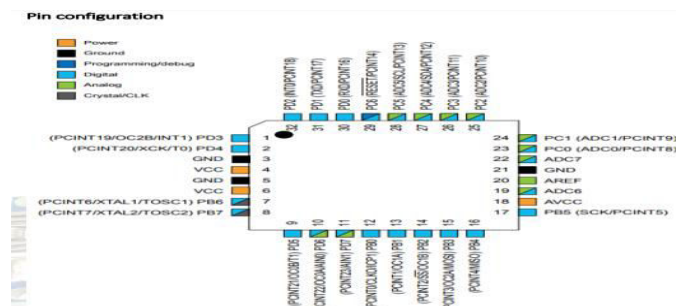


Fig no: 3 ESP8266-01 node MCU

3 VOLTAGE SENSOR

A strain gauge is a sensor used to calculate and monitor the amount of stress in an object. Voltage sensors can determine the level of AC or DC voltage. The input of this sensor is voltage, the output is switches, analog voltage signal, current signal or audio signal. Sensors are devices that can sense or identify and respond to certain types of electrical or optical signals.

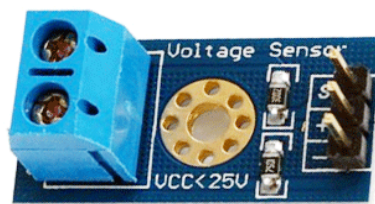


Fig no:6 voltage sensor

5 DYNAMO PELTON TURBINE MOTOR

A Pelton turbine is a tangential flow impulse turbine in which pressure energy water is converted to kinetic energy produced an high-velocity water jet and this jet impinges tangentially on the wheel to make its rotate. It is also called a Pelton wheel. A Pelton wheel is a type of water turbine (specifically an impulse turbine) often used to hydroelectric power plants. These turbines are generally used for sites with a drop of more than 300 meters. This type of turbine was created during the gold rush of 1880 by Lester Pelton. The water in a Pelton turbine moves fast and turbine extracts energy from the water by slow water down, making it's an impulse turbine.



Fig no: 7 Pelton turbine motor

6. RELAY

A relay is an electrical switch that opens and closes the control of another electrical circuit. Because the relay is baled to drive an output circuit with a higher power than the input circuit, it can be considered in the broad sense a form of electrical amplifier.

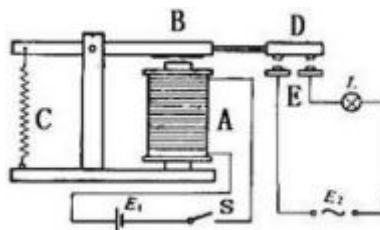


FIG:8 Diagram for relay

8 LCD Display

Reflective twisted nomadic liquid crystal display.

1. Polarizing filter film with a vertical axis to polarize the light at the entrance.
2. Glass substrate with ITO electrodes. The shapes of the electrodes determine that appear when the LCD is turned on.
3. Twisted nematic liquid crystal.
4. Common electrode film (ITO) glass substrate with horizontal grooves for alignment with the horizontal filter.
5. Polarizing filter film with a horizontal axis to block/transmit light.

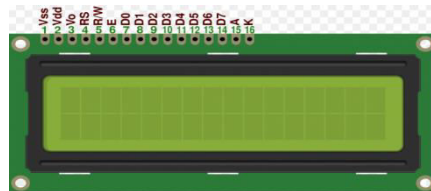


Fig no:10 Liquid crystal display

10. 6V BATTERIES

The battery system stores excess solar energy for later use. A BATTERY extends the use of energy generated by a photovoltaic system, providing free, sustainable energy even when the sun is not shining and the panels are not producing power. So with a BATTERY, little or no electricity is supplied to the grid and at the same time you avoid buying expensive electricity from the grid later. Due to increased self-consumption, electricity costs fall significantly. You pay less for the kWh you use.

11 DC-DC Boosters XL6009E1

The boost converter is one of the simplest types of switching converters. As the name suggests, it takes the input voltage and boosts or boosts it. It just consists of an inductor, a solid state switch (nowadays it's a MOSFET because you can get really nice ones these days), a diode and a capacitor. A periodic square wave source is also needed.



Fig:13 block diagram for dc-dc booster



12 LINEAR VOLTAGE REGULATER

All voltage sources cannot provide a fixed output due to circuit fluctuations. Voltage regulators are implemented to achieve constant and stable performance. ICs that are used for voltage regulation are called voltage regulator ICs. Here we can discuss IC 7805. This controller IC also add provision for a heatsink. The input voltage to the voltage regulator up to 35V, and this IC can provide a constant 5V for any input value less than or equal to 35V, is the threshold limit.

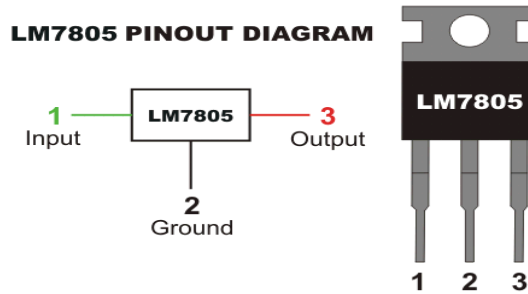


Fig no:14 Linear Voltage Regulator

VIII.RESULTS

In our setup we that we are getting free electricity by using Inline Pelton wheel turbine. Here we will not provide any extra resource to generate electricity. So, our project is economic and cost effective. Hence, we will design the micro hydro power plant setup for electricity generation.

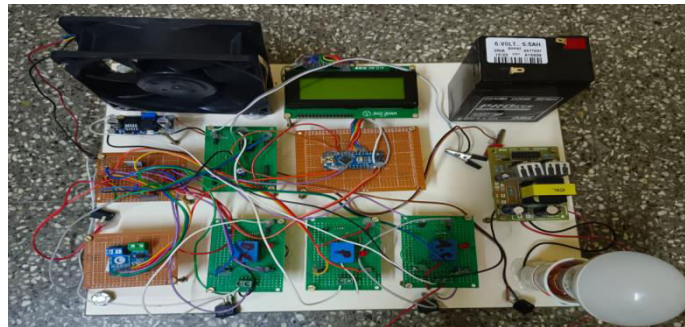


Fig no: Kit overall setup



Fig no: Pelton turbine



IX.CONCLUSION

In conclusion, the goal of this project is to understand the concept and process of generating electricity using the gravitational force of water. It can therefore be concluded that this system is very effective as an alternative way of producing electricity, because the source is waste water and it does not have a limited supply. In addition, the design cost of this project is cheap compared to other technologies. The most important parts to consider when designing with a turbine. The Pelton turbine is a universal turbine, where it can work in both low and high head. In addition, this project is able to analyze the generator output based on the turbine rotation speed. Based on this project, the pulley system is applicable to increase the efficiency of the turbine. As a recommendation, this project can be further improved with a proper prototype design. By increasing the number of blades on the turbine, you get the optimal turbine rotation speed. It is also recommended to increase the number of turns in the coil and the intensity of the magnetic field in the magnet on the generator. For improvement, it is proposed to connect the DC output to the battery for charging purposes.

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