A
Project Report
on

"HydroVolt Faucet"

Submitted By

Group 4 of Batch EN4

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Abstract

In response to escalating energy demands and the urgent need for sustainable solutions, the Hydro-Volt Faucet project presents a pioneering venture in the realm of renewable energy. This project endeavors to innovate a micro hydroelectricity tap system designed to harness the kinetic energy from water flow within household taps. By ingeniously converting water pressure into electrical power, this system aims not only to provide a water source but also to contribute significantly to the landscape of renewable energy sources and conservation efforts.

The core objectives encompass the design, development, and implementation of an efficient micro hydroelectricity tap system. This system will leverage a specialized tap mechanism to capture kinetic energy from flowing water, integrate a micro hydro turbine generator for the conversion of mechanical energy into electrical power, and establish a circuitry system to regulate and maintain the output voltage.

The motivation behind this idea is driven by the compelling potential of renewable energy sources. By tapping into the ubiquitous nature of water taps in households, commercial spaces, and public facilities, this project envisions a distributed network of energy sources. The innovative system aims to not only encourage efficient energy utilization but also to foster conscious water usage by associating it with electricity generation, thereby aligning with sustainability goals.

Furthermore, this project's impacts span a broad spectrum, from promoting clean and renewable energy generation at the point of use, reducing reliance on traditional energy grids, to encouraging water conservation and fostering education and awareness about renewable energy sources. The Hydro-Volt Faucet project represents a pivotal step towards a more sustainable and equitable energy future.

Overall, this endeavor seeks to manifest a functional micro hydroelectricity tap, exhibiting the potential for decentralized and sustainable energy generation at the household level, thereby paving the way for a more energy-efficient and environmentally conscious future.

- **Introduction:** In an era characterized by increasing energy demands and the need for sustainable solutions, our project aims to innovate a micro hydroelectricity tap that generates electrical power as water flows through it. This tap not only provides a water source but also harnesses the kinetic energy of flowing water to generate electricity, contributing to renewable energy sources and conservation.

- **Objective:**

1. **Design:** The design objective of this project is to engineer an innovative tap mechanism adept at efficiently capturing kinetic energy from water flow. This involves developing a specialized system that optimizes energy extraction from the flowing water, ensuring maximum conversion of kinetic energy into electrical power.

2. **Develop:** The development objective revolves around constructing and enhancing a micro hydro turbine generator system. This system will convert the mechanical energy obtained from the tap's kinetic mechanism into a stable and usable electrical output. The focus is on refining the design to ensure consistent and reliable power generation.

3. **Implement:** The implementation objective aims to seamlessly integrate the designed tap mechanism and the micro hydro turbine generator into a fully functional system. The emphasis lies in ensuring compatibility with various water supply setups, ease of installation, and efficient utilization, allowing for effective generation of electricity during regular water usage.

4. **Sustainable Energy:** This objective focuses on establishing a sustainable energy source by harnessing the kinetic energy present in water flow. The project seeks to demonstrate the viability of generating clean and renewable electricity directly from water taps, contributing to sustainable energy practices and reducing dependency on conventional power grid.

- **Literature Survey:**

- Hydropower Basics - U.S. Department of Energy

This resource provides fundamental insights into hydropower, explaining the generation of electricity from water flow and its applications in sustainable energy production.

- Small Hydropower Systems" - U.S. Environmental Protection Agency (EPA)

This publication could offer insights into small-scale hydropower systems, potentially providing case studies, technical details, and implementation strategies for compact hydropower solutions.

- Design and Performance Analysis of a Micro Hydro Power Plant for Rural Electrification" - International Journal of Sustainable and Green Energy

This research article, authored by A. Gnanam, M. Boopathi, et al., published in 2012, could delve into the technical aspects of designing micro hydroelectricity systems, offering valuable insights into efficiency, performance analysis, and rural electrification through micro hydro solutions.

- Journals and Papers on Hydropower Technology

Exploring various academic papers, journals, and publications related to hydropower technology could

provide detailed information on turbine design, energy conversion efficiency, control systems, and innovations in the field. This could include studies on impulse turbines, micro hydro turbine generators, and voltage regulation in hydroelectric systems.

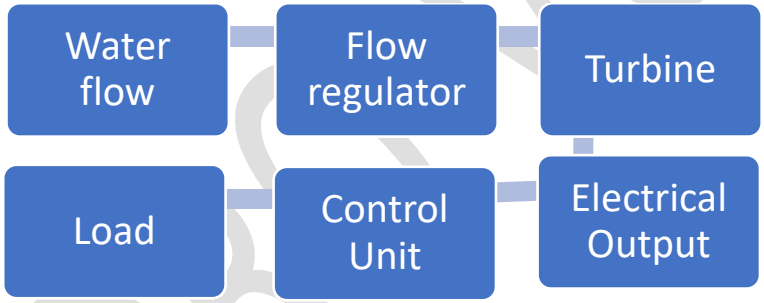
- Studies on Sustainable Energy Innovations

Reviewing broader studies or reports on sustainable energy innovations might provide context and comparison to similar projects worldwide. Investigating how other initiatives tackle similar challenges, their successes, limitations, and technological advancements could offer valuable insights.

- Industry Reports and Innovation Articles

Industry reports or articles in innovation-focused publications may highlight cutting-edge advancements, market trends, and potential commercial applications for micro hydroelectricity technologies. This could shed light on the commercial feasibility and scalability of similar projects.

- **Process Flow Chart**



- **Block Diagram:**

Why this Idea?

The concept of a micro hydro electricity tap is driven by several compelling reasons that underscore its relevance and significance in the current energy landscape. Here's why we find this idea noteworthy:

1. **Renewable Energy Generation:** The idea taps into the potential of renewable energy sources. Hydropower is a proven, reliable, and sustainable source of energy that can be harnessed from flowing water, contributing to reducing dependence on fossil fuels and mitigating environmental impact.
2. **Widespread Applicability:** Water taps are ubiquitous in households, commercial spaces, and public facilities. By integrating electricity generation with these taps, we can potentially create a distributed network of energy sources that spans across various settings.
3. **Efficient Energy Utilization:** Water flowing through taps possesses kinetic energy. Converting this energy into electricity directly at the point of use avoids transmission losses associated with centralized power generation and distribution, resulting in more efficient energy utilization.
4. **Energy Conservation:** The micro hydro electricity tap encourages conscious water usage by associating it with electricity generation. Users may be motivated to reduce water wastage, aligning with broader sustainability goals.
5. **Localized Power Generation:** The project promotes decentralized power generation, empowering individuals and communities to produce their own electricity. This is particularly relevant for remote areas or regions with unreliable power infrastructure.
6. **Educational Value:** Developing a functional micro hydro electricity tap provides an excellent educational tool. It can raise awareness about renewable energy, hydroelectricity, and the principles of energy conversion among students and the general public.
7. **Innovation and Research:** Creating a practical system that converts water flow into electricity involves interdisciplinary research, innovation in tap design, turbine technology, energy storage solutions, and control systems. This project serves as a platform for exploring these aspects.
8. **Potential for Commercialization:** If successful, the micro hydro electricity tap could have commercial applications. It might be integrated into new or existing water tap products, offering consumers an eco-friendly choice that generates value beyond just water supply.
9. **Environmental Benefits:** By generating electricity through clean hydropower, the idea contributes to reducing greenhouse gas emissions and environmental pollution, aligning with global sustainability targets.
10. **Empowering Sustainability:** The micro hydro electricity tap embodies the spirit of sustainable development. It showcases how everyday activities can be transformed into sources of clean energy, enabling individuals to be active participants in a greener future.

In conclusion, the idea of a micro hydro electricity tap is not only innovative but also aligned with pressing energy and environmental challenges. It holds the promise of localized, sustainable, and efficient energy generation while promoting awareness and action towards a more sustainable world.

- **Methodology:** The project will involve the following key steps:
    1. Designing a specialized tap mechanism that efficiently captures the kinetic energy from flowing water.
    2. Incorporating a micro hydro turbine generator to convert the mechanical energy into electrical energy.
    3. Developing a circuit to control and maintain output voltage.

- **Impact:**

The impact of the Micro Hydro Electricity Tap project can be substantial and wide-ranging, with both immediate and long-term effects. Here are some key impacts:

1. **Clean Energy Generation:** The project contributes to clean and renewable energy generation at the point of use, reducing reliance on fossil fuels and decreasing greenhouse gas emissions.
2. **Energy Access:** Provides a sustainable source of electricity to households, especially in remote or underserved areas where access to the grid is limited, improving the quality of life.
3. **Environmental Benefits:** Reduces the carbon footprint by harnessing hydropower, a clean energy source, which helps combat climate change and air pollution.
4. **Energy Efficiency:** Enhances energy efficiency by capturing the kinetic energy of flowing water directly, reducing energy losses associated with long-distance transmission.
5. **Water Conservation:** Encourages water conservation as users become more mindful of their water usage, aligning with water conservation goals.
6. **Education and Awareness:** Raises awareness about renewable energy, hydropower, and sustainable living, educating individuals about the importance of responsible resource consumption.
7. **Economic Opportunities:** Creates opportunities for local manufacturing, installation, and maintenance of micro hydroelectricity taps, potentially stimulating job growth.
8. **Technological Advancement:** Drives innovation in micro hydro turbine technology, energy storage solutions, and control systems, contributing to advancements in these fields.
9. **Scalability:** Offers a scalable model for sustainable energy generation, which can be replicated in various settings, including homes, schools, and commercial establishments.
10. **Reduction in Energy Bills:** Helps users lower their electricity bills by generating power for their own consumption, potentially leading to cost savings over time.
11. **Reduced Energy Poverty:** Contributes to reducing energy poverty by providing affordable and reliable electricity access to underserved populations.
12. **Government Policy Influence:** Demonstrates the feasibility and benefits of decentralized renewable energy, potentially influencing government policies to support similar initiatives.

Overall, the Micro Hydro Electricity Tap project has the potential to make a significant positive impact on the environment, energy access, economic development, and community empowerment. It aligns with global sustainability goals and represents a step towards a more sustainable and equitable energy future.

- **Scope:** The project scope encompasses the design, fabrication, and testing of the micro hydroelectricity tap system. It includes assessing the tap's efficiency, power generation capacity, and compatibility with different water supply systems and a unit to store the excess electricity generated.

- **Expected Outcomes:** Upon successful implementation, the project aims to achieve:
    1. A functional micro hydroelectricity tap capable of producing electricity during water usage.
    2. A proof-of-concept for sustainable energy generation at the household level.

- **Plan of Action:**

Actions	Date	Outcome
Title Decision	1st week of August	Finalized
Data Analysis/Research	2-4 weeks of August	Finalized
Synopsis	1st week of September	Finalized
Components Requirements	From 1st week of September	Finalized
Simulation	October	Finalized
Prototype Building	November-December	Finalized

- **Resources Required:**
    1. Water taps components and materials.
    2. Impulse Turbine.
    3. Micro hydro turbine generator. (Around 250rpm Motors)
    4. Tools for fabrication and assembly. (needs access of 3D printer)
    5. Capacitors, Wires.

- **Components and Budget:**

Sr. No	Name of Component	Quantity	Price Rs.
1.	LM7812	1	199
2.	PCB (Single Sided)	1	13
3.	3-D Printed Casing	1	199
4.	3-D Printed Turbine	1	49
5.	Jumper Cables	10	20
6.	12-24V DC Motor	1	127
Total Rs.			Approx. 607

LM7812 IC

- Three-Terminal Voltage Regulator
- Input Voltage: 12-34V
- Analog Pins: 3

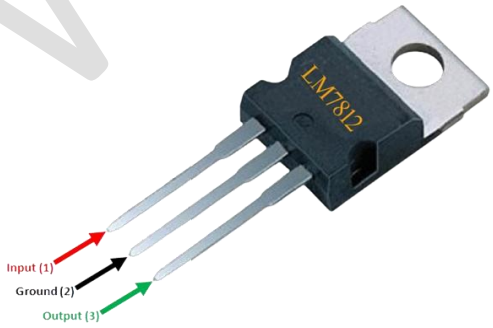


Figure 4.1: LM7

Jumper Cables:

- Compatible with 2.54mm spacing pin headers
- 40pcs chromatic colour jump wire
- Durable and reusable
- Easy to install and use

Figure 4.3: Jumper Wires

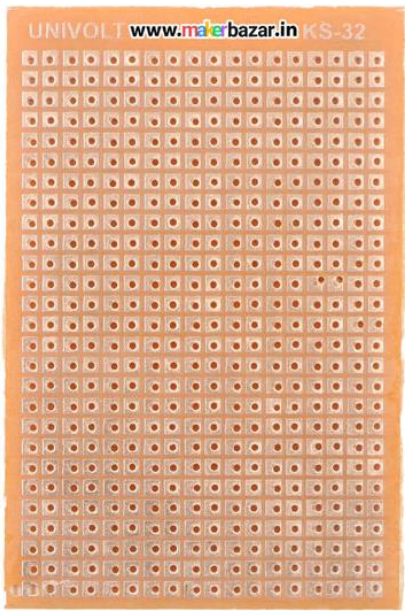


Figure 4.2: Relay Module

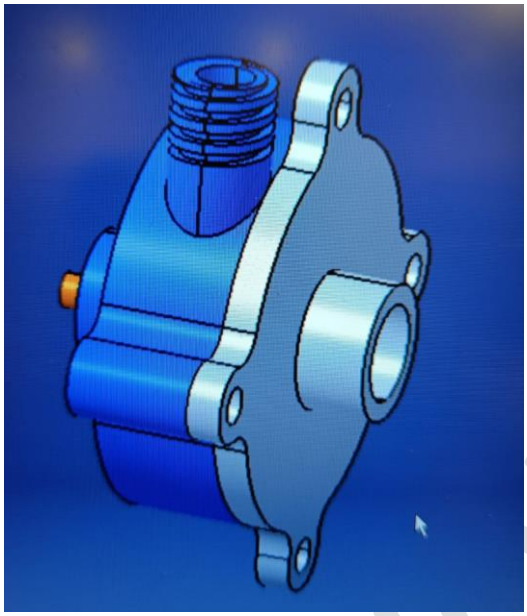


Figure 4.3: Casing

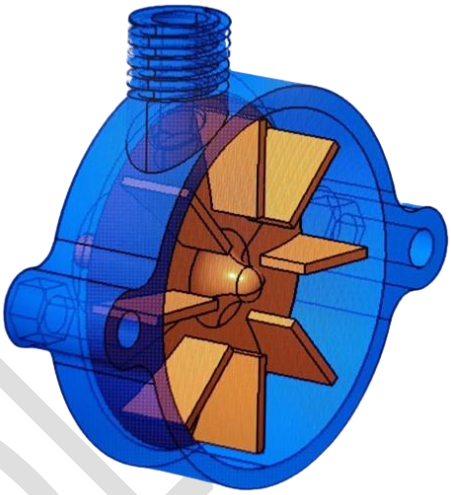
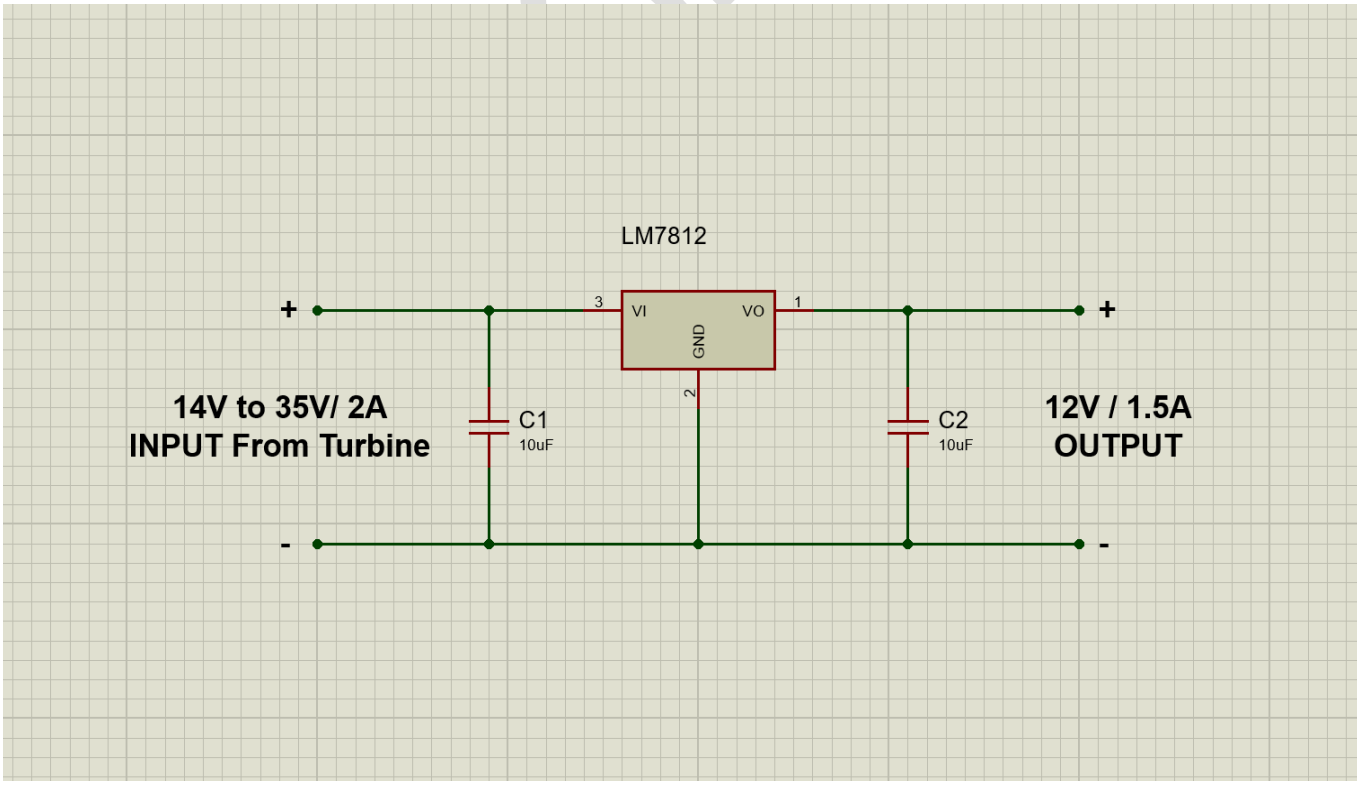
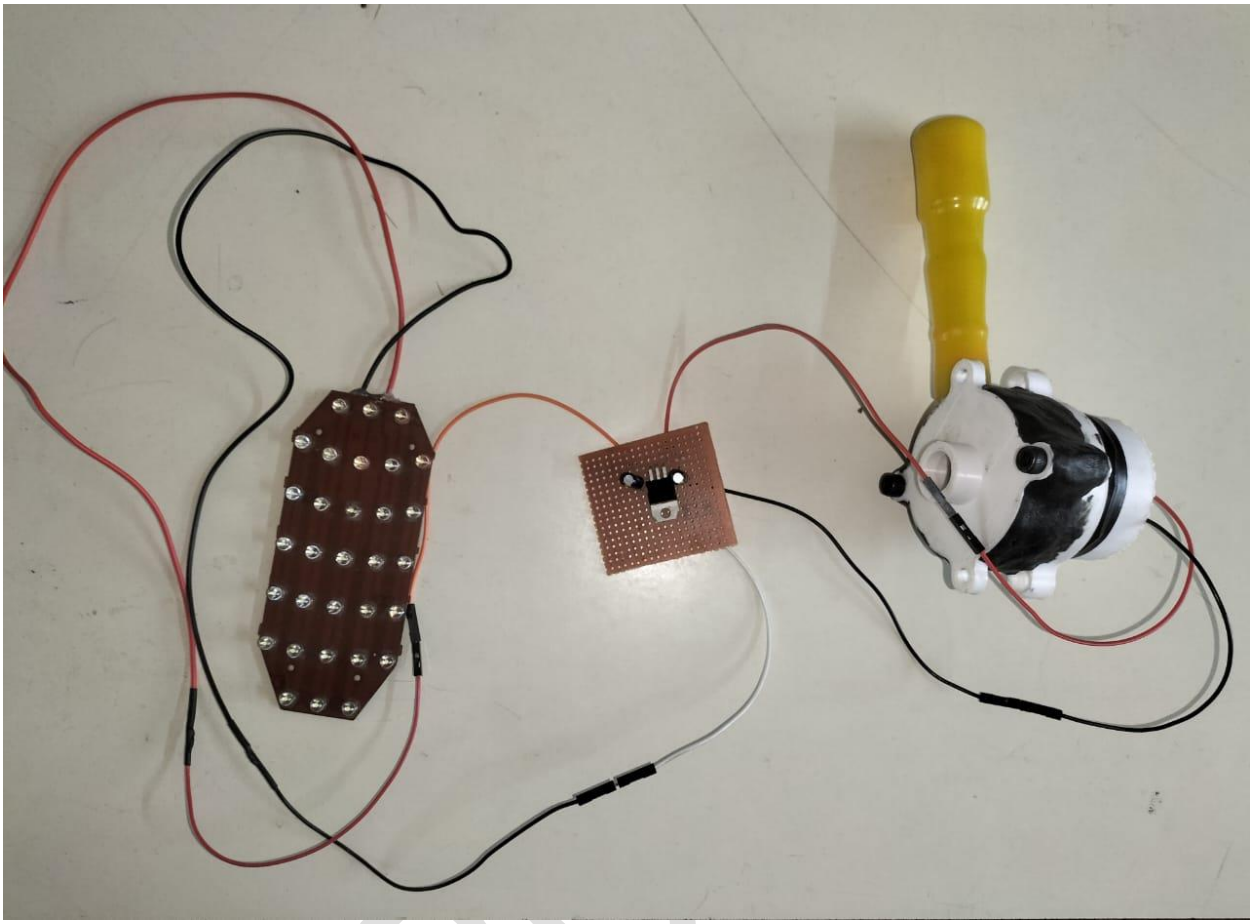


Figure 4.3: Turbine

- **Circuit Diagram:**



- **Device Connections:**



- **Future Enhancements:**

1. Energy Storage Integration
2. Enhanced Turbine Efficiency
3. Variable Output Control
4. Integration of Control Unit

- **References:**

1. “Hydropower Basics" - U.S. Department of Energy
    - Website: Hydropower Basics
2. "Small Hydropower Systems" - U.S. Environmental Protection Agency (EPA)
    - Website: Small Hydropower Systems
3. "Design and Performance Analysis of a Micro Hydro Power Plant for Rural Electrification" - International Journal of Sustainable and Green Energy
    - Authors: A. Gnanam, M. Boopathi, et al.
    - Published in 2012