JOURNAL LA MULTIAPP

VOL. 04, ISSUE 01 (043-048), 2023
DOI: 10.37899/journallamultiapp.v4i1.812

A Hydro Wheel System in A Non-Natural Pond Using Renewable

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Article Info

Article history:
Received 27 July 2023
Received in revised form 29 August 2023
Accepted 2 October 2023

Keywords:
Renewable Energy
Artificial Pond
Hydro Wheel
Ecosystem
Energy Conversion

Abstract

One of the most cost-effective ways to generate electricity is through waterwheels. Because of the need for clean energy and sustainable electricity production, hydropower currently plays an important role in meeting energy demand. Although water wheels were studied academically as early as the eighteenth century, they were mostly ignored until the twentieth century. Only in the last two decades has there been a revived interest in their use among scientists. The researcher came up with this topic to discuss its benefits and how it will be beneficial in our daily lives and make our surroundings safe, which needs enough light and helps the school or park premises lighten up the dark areas at night. Having enough illumination inside the premises of in schools and parks, according to numerous sources and data gathering findings, will help folks become comfortable in the location they are staying or visiting. Good illumination can help with mobility, safety, and security.

Introduction

The discovery of hydropower (Dolter et al., 2022) (Zahid et al., 2022) represents a tremendous technological accomplishment for humanity. The researchers created this topic to highlight its benefits and how it would aid individuals in their daily lives as well as keep the surroundings safe, which requires adequate lighting. Nunungan is the largest town in Lanao del Norte by land area (PhilAtlas, 2023), with a population of almost 18,500 people. A village 2,000 feet above sea level and situated more than 100 kilometers outside Iligan City has never had electricity." Even though it has been a century since the creation of electricity, and it is now progressively evolving in the modern world in terms of how it may be produced, the problem of a lack of electricity (Huy et al., 2021) in distant locations has not been resolved (Dong et al., 2022).

San Jose Del Monte, Bulacan, with the tagline "The Rising City," is likewise suffering with the same issue. San Jose Del Monte, Bulacan's topography is mountainous, and some areas will be difficult for the government to supply with electricity due to their steepness and distance from civilization. Even at Bulacan State University-Sarmiento Campus, there is a paucity of lighting systems in various places of the campus at night, resulting in uncomfortable and unsafe situations for students and campus workers. With this concern in mind, the researchers devised a waterwheel system (Corriga et al., 1988) that can generate electricity to power lighting equipment, thereby assisting students and campus personnel by creating light to make them feel safe and comfortable on campus premises.

ISSN: 2716-3865 (Print), 2721-1290 (Online)

The study's goal is to build a water wheel device in an artificial pond (Linares et al., 2023) to generate free energy to power lighting gadgets (Tawalbeh et al., 2023) and to promote eco-friendliness among people. Moreover, the project aims to be evaluated in terms of eco-friendliness, cost effectiveness, functionality, sustainability and reliability. It helps to illuminate the school grounds at night, especially since some Bulacan State University-Sarmiento Campus students still conduct classes. The device will generate electricity to power lighting systems that would allow students and faculty members at the Bulacan State University-Sarmiento campus to walk around the campus safely and comfortably at night. Water wheels are a useful technique of generating renewable energy that can be utilized to power some of the lighting equipment that assist brighten the campus due to their low cost, low environmental impact, and good performance.

Renewable energies (Alonso, 2022) provide clean, limitless, and increasingly competitive energy. They differ from fossil fuels primarily in their variety, abundance, and ability to be used anywhere on the earth. Above all, they emit neither greenhouse gases, which cause climate change, nor harmful emissions (Liao et al., 2023). Using renewable energy to generate energy can have a greater impact in our daily lives, particularly on school grounds, where it can power some lighting devices and make the Bulacan State University - Sarmiento campus safer and more comfortable for all students and faculty members regardless of their schedules. Waterwheels have clear aesthetic advantages over turbines and are a fantastic attraction at visitor-friendly locations (Cleynen et al., 2021) which can produce 3000 watts per day. This device can also be used by drafting students, landscape designers, and garden enthusiasts to improve the design of a garden or open area. This gadget is not only used to generate power, but it can also be utilized for landscape design to improve the appearance of a garden or open area

Methods

Because of its applicability to the situation, the researcher adopted the quantitative research approach to collect considerable data (Borela et al., 2020). Quantitative research uses scientific inquiry to answer questions about the sample population by collecting and analyzing data that may be observed or measured. Quantitative research employs scientific inquiry and depends on data that is observed or measured to investigate questions about the sample population. Overall, stratified sampling is used in the study, with respondents divided into subgroups based on their characteristics. This sample strategy will be used to partition the results, allowing for data comparison among different sorts of responders. The survey questionnaire was printed and fillable forms on Google Forms were utilized to collect data in this study. Survey questionnaires are designed to collect and organize the information required to solve the challenges identified by the researcher. The selected respondents' opinions were determined by the initial survey form. The opinions then shape how the intended output is created. Surveys will be distributed to students and university workers using Google Forms and printed forms. The researchers will conduct the final evaluation using the same research instruments. To help respondents understand the concept and see what they are evaluating, the researchers will employ video presentations and generate proposal plans.

Figure 1 is a schematic representation of the hardware components, which depicts the connections between all of the system's hardware components. When the motor generates electric current with the help of the waterwheel, it displays how mechanical energy is converted into electric energy. The current is then stored in the battery and used to power the water pump, which in turn powers the waterwheel. Consider the environments where it should be built,

ISSN: 2716-3865 (Print), 2721-1290 (Online)

affecting the height and materials used in the output proposal. Elevate the look and feel of the output proposal.

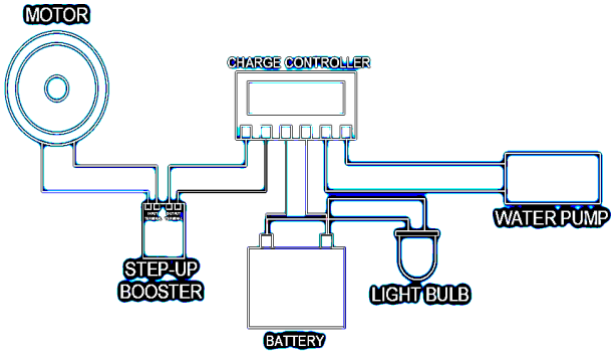

Figure 1. Schematic Diagram

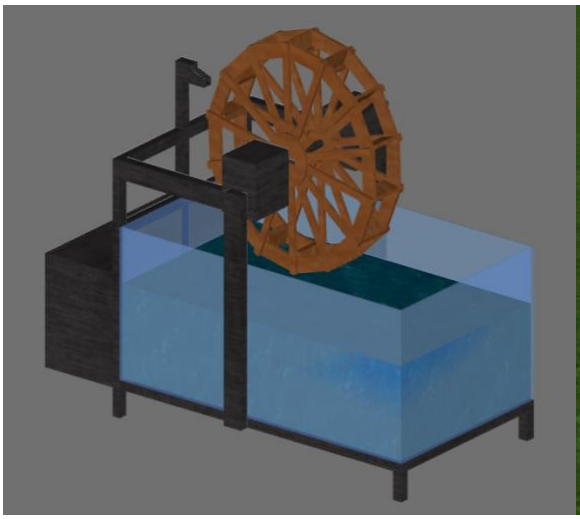

Figure 2. Proposed prototype

Figure 3. Proposed design

A prototype was developed to evaluate the efficiency of a standalone water wheel using hydro system which can be seen in figure 2 and the designed application in a large scale is found in figure 3. The devices will be embedded underground.

Results and Discussion

The proposal evaluation data will be used to establish whether the plan satisfied all of the criteria for eco-friendliness, cost-effectiveness, functionality, sustainability, and reliability, and thus whether the proposal is accepted, acceptable, or practicable. The data displayed in the tables below represent the scores given by the selected few respondents when evaluating the output proposal for the study.

Table 1. Survey results in terms of Eco-Friendliness

Eco-Friendliness	Mean	Interpretation
Functionality. Ability to utilize renewable sources of energy (hydropower).	4.34	Highly Acceptable
Reusability. Ability to reuse renewable sources of energy several times.	4.38	Highly Acceptable
Promotability. Ability to motivate people to use renewable energy sources.	4.26	Highly Acceptable
Average Mean	**4.33**	**Highly Acceptable**

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The functionality sub-criteria received an average mean of 4.34, the reusability sub-criteria received an average mean of 4.38, and the promotability sub-criteria received an average mean of 4.26 for the Eco-friendliness criteria, all three criteria interpreted as Highly Acceptable. Overall, the average mean for the Eco-friendliness criteria is 4.33, interpreted as Highly Acceptable. The projects projectile to promote eco-friendliness in an outdoor setting lets the people to apply reusable energy.

Table 2. Survey Results in Terms of Cos Effectiveness

Cost-Effectiveness	Mean	Interpretation
Affordability. The proposal's cost's reasonability.	3.99	Acceptable
Practicality. The availability of the materials used in the market.	4.12	Acceptable
Conformity. Considering the components and functions, one's perception of the proposal's compliance.	4.07	Acceptable
Average Mean	**4.06**	**Acceptable**

The affordability sub-criterion received an average mean of 3.99, the practicality sub-criteria received an average mean of 4.12, and the conformity sub-criteria received an average mean of 4.07, all three criteria evaluated as Acceptable for the Cost-Effectiveness criteria. The overall mean for the Eco-friendliness criteria is 4.06, which is considered as Acceptable.

Table 3. Survey results in terms of Functionality

Functionality	Mean	Interpretation
Understandability. The functions of the proposal are simple to understand.	4.31	Highly Acceptable
Usability. Perceived ability of the proposal to be operated easily within a specific environment.	4.30	Highly Acceptable
Installation. Ease of installation of the proposal and its hardware.	4.15	Acceptable
Average Mean	**4.25**	**Highly Acceptable**

For the Functionality criteria, the understandability and 'usability' sub-criteria received an average mean of 4.31 and 4.30, respectively, interpreted as Highly Acceptable; and the installation sub-criteria received an average mean of 4.15, interpreted as Acceptable. The overall mean for the Functionality category is 4.25, which is considered as Highly Acceptable.

Table 4. Survey results in terms of Sustainability

Sustainability	Mean	Interpretation
Maintainability. The ability of the proposal to sustain its function in a given environment.	4.13	Acceptable
Innovativeness. Perceived ability to introduce new technology among its possible users within the country. Openness; for further improvements and constant innovation.	4.29	Highly Acceptable
Sufficiency. The ability of the proposal to serve its purpose/solve the core of the research problem.	4.21	Highly Acceptable
Average Mean	**4.21**	**Highly Acceptable**

ISSN: 2716-3865 (Print), 2721-1290 (Online)

The sustainability sub-criteria received an average mean of 4.13, considered as Acceptable; the innovativeness sub-criteria received an average mean of 4.29, interpreted as Acceptable; and the sufficiency sub-criteria received an average mean of 4.21, regarded as Highly Acceptable. The overall mean for the Functionality criteria is 4.21, which is considered as Highly Acceptable.

Table 5. Survey results in terms of Reliability

Reliability	Mean	Interpretation
Resilience. Perceived ability of the proposal to withstand wear and damage caused by natural phenomena.	4.22	Highly Acceptable
Compliance. Adherence to industry standards—materials and hardware.	4.19	Acceptable
Recoverability. Ability to bring back a failed system to its operation.	4.21	Highly Acceptable
Average Mean	**4.21**	**Highly Acceptable**

For the Reliability criteria, the resilience sub-criteria received an average mean of 4.22, which was interpreted as Highly Acceptable; the compliance sub-criteria received an average mean of 4.19, which was interpreted as Acceptable; and the recoverability' sub-criteria received an average mean of 4.21, which was interpreted as Highly Acceptable.

Conclusion

The project sustained renewable energy system which stored above 5% of energy saving. The wheel has less friction that led to a suitable renewable energy harvesting while the project is in the phase 1, Scavenging energy through reverse mechanism using hydro wheel, the project will be implemented in a small pond. The project also obtained 4.212 in the survey which is highly acceptable in terms of eco friendliness, cost effectiveness, functionality, sustainability and reliability. While eco-friendliness was obtained to have a mean of 4.33, the environmental benefits are very applicable in the project. With the high impact of the project to illuminate parts of the school, phase 2 will be applied in a larger scale which can illumine 25 bulbs with 9 watts each which will run for 12 hours with a total of 2700 watts. The projected energy generation of the hydro wheel is 5000 watts while other projects can only produce 3000 watts per day.

Acknowledgment

I would like to extend my deepest gratitude to Bulacan State University and to the different departments we are involved in, Industrial Technology and Information Technology. With the help of some of our student which made the project possible.

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