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Green T: A healthy hybrid clean energy harvester for promoting exercise and mitigating energy problems

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Key words: Alternative Power source, Indoor cycling, Workplace exercise, Green T, Clean energy

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Abstract

The present technical investigation aimed to fabricate a hybrid alternative power source for immediate solution to a fluctuating and power rationing communities, disaster affected areas, off grid communities, and mitigation of the impact of climate change and at the same time it can be used as an exerciser pedal power permanent magn*et al*ternator for sedentary individual. The research method used was the Technical Developmental Type of research, where the methodology described the factors that contribute to the fabrication of the Green T. Findings revealed that the fabricated Green T: A Healthy Hybrid Clean Energy Harvester is a very good exercise unit that can burn more calories for users per minute compared with the standard sedentary individual thus helping promote healthy lifestyle among its citizenry as an exercising unit through pedaling while they are in the office working their respective task. It is recommended that the fabricated Green T: A Healthy Hybrid Clean Energy Harvester would be utilized as an alternative source of power to off-grid and on-grid communities, to partially solve the energy problem of the country Green T can be used as a spring board research to fabricate new innovations and inventions of more exercising units inside the office without compromising office work outputs and for the office to have an independent power source to energize computers, cellphones and other gadgets.

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Introduction

This study has global significance as it addresses two critical issues that affect all nations: the need for physical activity to promote health and the need to mitigate the harmful effects of climate change. The importance of physical activity in preventing chronic diseases and promoting overall health has been recognized by many countries. For example, the World Health Organization (WHO) has recommended that adults engage in at least 150 minutes of moderate-intensity physical activity per week to maintain good health (World Health Organization, 2021). Similarly, many countries have enacted policies to promote the use of renewable energy sources to mitigate the harmful effects of climate change. For instance, the European Union has set a target to produce 32% of its energy from renewable sources by 2030 (European Commission, 2018).

Physical activity is an essential lifestyle behavior when it comes to promoting health and preventing a myriad of disabling ailments and diseases. This statement is based on the conclusion of hundreds of scientist and health professionals who reviewed thousands of scientific studies showing that physically active people have higher levels of health-related fitness, a lower risk profile for developing number of disabling medical conditions, and lower rates of various chronic degenerative diseases, (Jones, *et al.*, 2021). In addition, indoor cycling may improve aerobic capacity, blood pressure, lipid profile, and body composition. These enhancements may be achieved as standalone intervention or combined with other physical exercises or diet. The combination of indoor cycling and diet is recommended to improve the lipid profile, lose weight, and reduce blood pressure. Furthermore, indoor cycling alone may also enhance aerobic capacity (Chavarrias, M., *et al.*, 2019.

The research aims to develop an innovative piece of furniture called the Green T, which serves a dual purpose as both a table and an exercise unit. The Green T is designed to allow busy individuals to engage in physical activity while working and generating clean energy to power their homes and offices. The research objectives include designing and fabricating the Green T as an alternative source of power for off-grid and on-grid communities and assessing its effectiveness as an exercise unit for sedentary office workers. The research also aims to evaluate the energy output and efficiency of the Green T. This research aligns with the global efforts to mitigate the impact of climate change and promote sustainable energy sources and healthy lifestyle behaviors. The research on designing and fabricating the Green T as a healthy hybrid clean energy harvester has a global context, but for the purposes of providing a continental context, we will focus on the Asia-Pacific region there is a growing concern over the impact of climate change and the need for sustainable energy sources. The region is home to some of the world's largest polluters, such as China and India, and is also vulnerable to the effects of climate change, including rising sea levels, extreme weather events, and food and water insecurity (UNESCAP, 2020).

In response to these challenges, many countries in the Asia-Pacific region have developed policies and initiatives aimed at promoting clean energy and reducing greenhouse gas emissions. For example, Japan has set a target to achieve carbon neutrality by 2050, while China has pledged to reach peak carbon emissions by 2030 and achieve carbon neutrality by 2060 (Bloomberg NEF, 2021).At the same time, the Asia-Pacific region is also facing a growing problem of sedentary lifestyles and associated health risks. In many countries, urbanization and changing work patterns have led to more people working in office environments and engaging in less physical activity (World Health Organization, 2020). This has resulted in a rise in non-communicable diseases such as diabetes, cardiovascular disease, and obesity. The Green T represents a timely and relevant innovation that addresses both the need for sustainable energy sources and the need for promoting physical activity and healthy lifestyles in the Asia-Pacific region.

As the Philippines is located in the Southeast Asian region the Southeast Asian region is particularly vulnerable to the impacts of climate change, such as rising sea levels, increased frequency of extreme weather events, and loss of biodiversity. The region is also experiencing a rise in non-communicable diseases such as diabetes, heart disease, and obesity, which are linked to sedentary lifestyles. Therefore, the Green T table could be a valuable tool in promoting both physical activity and clean energy in the Southeast Asian region, as well as other regions facing similar challenges.

The research has global, regional, and continental relevance, as it addresses issues that affect all nations and regions, particularly those vulnerable to the impacts of climate change and sedentary lifestyles.

In the Asian region, the Philippines have taken steps to promote the use of renewable energy sources. The Republic Act Number 9513 of 2008 encourages the development and utilization of renewable energy resources to prevent or reduce harmful emissions and balance economic growth with environmental protection. The government's focus on renewable energy is in line with the United Nations Sustainable Development Goals, particularly Goal 7, which aims to ensure access to affordable, reliable, sustainable, and modern energy for all (United Nations, N.D.).The Green T table, which combines physical activity and the use of renewable energy, has global, continental, and regional relevance.

It can help individuals achieve the recommended level of physical activity while simultaneously contributing to efforts to mitigate the effects of Climate Change and Global Warming, the Philippine government codified the Republic Act Number 9513 of 2008 that "encourages the development and utilization of renewable energy resources as tools to effectively prevent or reduce harmful emissions and thereby balance the goals of economic growth and development with the protection of health and the environment". Harvesting clean and renewable energy from the different natural resources such as the sun, wind, oceans waves and large rivers must be a priority and be given with so much attention by the government and individuals so as to mitigate the harmful effect of carbon dioxide and carbon monoxide and other pollution that is the byproducts of using fossil fuels. Section 9 states that the Department of Energy shall establish a Green Energy Option program which provides end-users the option to choose Renewable Energy resources as their sources of energy. It is for these reasons that the researcher has undertaken the present investigation in order to fabricate a table to be named as Green T (Green Table) that is designed to be utilized by busy individuals, so that while sitting and working on top of the table, they may find time for exercising, stretching, and pedaling while at the same time harvesting the energy through it, converting that energy into electrical energy to light the offices and homes, charging gadgets such cellphones, laptops, and computers.

In response to these challenges, the present study aims to design and fabricate the Green T: A Healthy Hybrid Clean Energy Harvester. This innovative piece of furniture is designed to serve a dual purpose as both a table and an exercise unit, allowing busy individuals to engage in physical activity while working and simultaneously generating clean energy to power their office or home. The Green T represents a novel solution to the challenge of promoting sustainable energy sources and healthy lifestyles while mitigating the impact of climate change.

It is for these reasons that the researcher has undertaken the present investigation in order to fabricate a table to be named as Green T (Green Table) that is designed to be utilized by busy individuals, so that while sitting and working on top of the table, they may find time for exercising, stretching, and pedaling while at the same time harvesting the energy through it, converting that energy into electrical energy to light the offices and homes, charging gadgets such cellphones, laptops, and computers. In response to these challenges, the present study aims to design and fabricate the Green T: A Healthy Hybrid Clean Energy Harvester. This innovative piece of furniture is designed to serve a dual purpose as both a table and an exercise unit, allowing busy individuals to engage in physical activity while working and simultaneously generating clean energy to power their office or home.

The Green T represents a novel solution to the challenge of promoting sustainable energy sources and healthy lifestyles while mitigating the impact of climate change.

This research study lies in its potential to address several pressing issues facing modern society, namely, the need for sustainable energy sources, the promotion of healthy lifestyles, and the mitigation of the impact of climate change. By designing and fabricating the Green T, the study aims to offer a dual solution that allows busy individuals to engage in physical activity while working and simultaneously generating clean energy to power their office or home. This innovation has the potential to revolutionize the way we approach energy generation and physical activity in indoor environments, promoting greater sustainability, health, and productivity. Additionally, the study's findings could serve as a springboard for further research and innovation in designing more exercising units for use in indoor environments, creating new opportunities for sustainable energy generation and promoting healthy lifestyles. Overall, this research study has the potential to make a significant contribution to advancing our understanding of the intersection between sustainability, health, and productivity, and may ultimately lead to a more sustainable and healthier future.

This study is the need to promote sustainable energy sources and healthy lifestyles while mitigating the impact of climate change. The researcher aims to address this problem by designing and fabricating the Green T: A Healthy Hybrid Clean Energy Harvester, a piece of furniture that serves a dual purpose as both a table and an exercise unit, allowing busy individuals to engage in physical activity while working and simultaneously generating clean energy to power their office or home. The specific research objectives are to assess the effectiveness of the Green T as an exercise unit for promoting a healthy lifestyle among sedentary office workers and to evaluate its energy output and efficiency in generating clean energy from physical activity. The study also aims to recommend the utilization of the Green T as an alternative source of power and as an exercise unit in offices and homes, and explore its potential as a springboard for further research and innovation in designing more exercising units for use in indoor environments without compromising productivity. The specific research objectives of this investigation are to design and fabricate the Green T as an alternative source of power for off-grid and on-grid communities, disaster-affected areas, and to assess its effectiveness as an exercise unit for promoting a healthy lifestyle among sedentary office workers. Additionally, the study will assess the energy output and efficiency of the Green T in generating clean energy from physical activity, recommend its utilization as an alternative source of power and as an exercise unit in offices and homes, and explore its potential as a springboard for further research and innovation in designing more exercising units for use in indoor environments without compromising productivity.

Objectives of the Study

The research objectives of this investigation are to:

1. Design and fabricate the Green T as a hybrid clean energy harvester that serves as an alternative source of power for both off-grid and on-grid communities, disaster-affected areas, and mitigating the impact of climate change.
2. Determine the effectiveness of the Green T as an exercise unit, specifically in promoting a healthy lifestyle among sedentary office workers.
3. Assess the energy output and efficiency of the Green T in generating clean energy from physical activity.
4. Recommend the utilization of the Green T as an alternative source of power and as an exercise unit in offices and homes to promote a healthy lifestyle and reduce carbon emissions.
5. Explore the potential of the Green T as a springboard for further research and innovation in designing more exercising units for use in indoor environments without compromising productivity.

Materials and methods

Research method

This research study used the Technical Developmental Type of research (Yaakub & Majumbar, 2015); the methodology described the factors that contribute to the fabrication of the Green "T" that includes planning and designing where concepts and ideas were studied and analyzed; it was made possible thorough conceptualization involving designs, drawing, and schematic/block diagrams. After these, materials, tools, and equipment were specified and cost of production was calculated. Thereafter, fabrication of the project was performed in accordance with the plan and specification. Illustrated in the below is the study's flow.

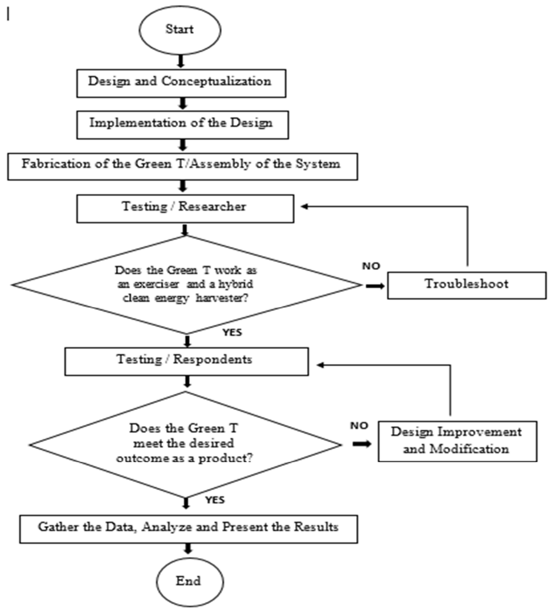

Fig. 1. Process of Fabrication.

Flow of the Study

The study involves the development process of Green T: A Healthy Hybrid Clean Energy Harvester, which is presented in Fig. 2. Initially, the design and concepts were outlined and presented in Fig. 1. The implementation of the design was followed by the fabrication of the Green T, which included the assembly of the system. Subsequently, the researcher performed testing to meet the desired outcome. If the Green T did not function as an exerciser and a hybrid clean energy harvester, it would undergo troubleshooting and be subjected to the testing process again. On the other hand, if the Green T worked, it would be tested by the respondents. In the event that the Green T did not meet the desired outcome as a product, it would go back to design improvement and modification. However, if it did meet the desired outcome, data would be gathered for analysis and presentation.

Environment

The study was carried out at the Jose Rizal Memorial State University (JRMSU) in Dipolog City, Zamboanga del Norte, Philippines. The study followed a systematic process, starting with the design and concept outline, followed by the implementation of the design and fabrication of the Green T. The Green T was then tested by the researcher, and if there was a negative outcome, it underwent the testing process again. If the Green T worked, it was tested by the respondents, and if it did not meet the desired outcome as a product, it went back to the design improvement and modification stage. The data gathered during the testing process were analyzed and presented.

Respondents/Users

Testing-run of the Green T. was conducted by the Faculty and Staff of Jose Rizal Memorial State University (JRMSU) Dipolog Campus, Dipolog City which composed of twenty two (22) males and thirty one (31) females. The heart rate of each of the respondents was monitored before, during, and after the test-run using a fingertip pulse/oximeter, and the calories consumptions were computed. The respondents provided their profile such as the age, sex, height, weight, and their physical activity status. During the five (5) minute test run, the performance output of the Permanent Magnet *al*ternator as to the voltage (V), current (A) and power (W), that was displayed from the direct current multi-meter and the charge controller were recorded.

Table 2. List of Materials.

Qty	Unit	Description
1	piece	DC 540 permanent magnet *al*ternator
1	Unit	Office Chair
1	set	Bicycle crank
1	piece	Cyclo Computer / Speedometer
1	Piece	Direct Current Multi Meter
1	Piece	BMX wheel (Front) 20"
1	Piece	Single Speed Sprocket 13 teeth
1	Piece	BMX Bike Chain
1	Pair	Bicycle Pedal
1	Piece	Solar charge controller 100 watts
1	piece	Deep cycle battery 26 ah
1	piece	Power inverter 1000 watts
3	Pieces	Pillow Blocks ¾"

The list of materials for the fabrication of the Green T: A Healthy Hybrid Clean Energy Harvester includes a DC 540 permanent magn*et al*ternator, an office chair, a bicycle crank, a cyclo computer or speedometer, a direct current multi-meter, a BMX wheel (front) with a size of 20 inches, a single speed sprocket with 13 teeth, a BMX bike chain, a pair of bicycle pedals, a solar charge controller with a capacity of 100 watts, a deep cycle battery with a rating of 26 ah, a power inverter with a capacity of 1000 watts, and three pillow blocks with a diameter of 3/4 inch. These materials were selected based on their compatibility with the design and functionality of the Green T. The permanent magn*et al*ternator serves as the energy harvester while the office chair, bicycle crank, pedals, and wheel provide the exercise equipment.

The conceptual design of the study is illustrated in the following diagram:

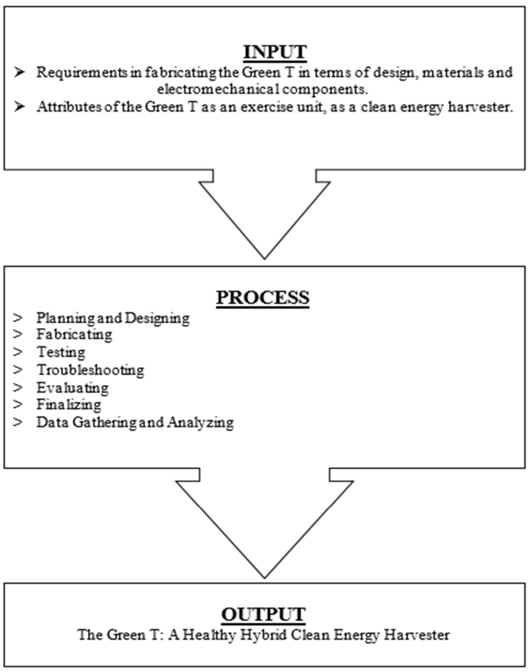

Fig. 1. Conceptual Paradigm of the Study.

The cyclo computer and direct current multi-meter serve as instruments to measure the speed and amount of energy generated. The solar charge controller and deep cycle battery store and regulate the energy produced while the power inverter converts the stored energy into usable power. The pillow blocks provide support and stability for the wheel and sprocket assembly. This study aimed to fabricate a hybrid alternative power source for immediate solution to fluctuating and power rationing communities, disaster affected areas, and off grid communities in order to mitigate the impact of climate change and at the same time it can be used as an exerciser pedal power permanent magnet alternator.

The study has utilized the system approach model. The input that includes the requirements in fabricating the Green Table in terms of design, materials, electromechanical components, and the attributes of the Green Table as an exerciser and clean energy harvester. The process starts with the planning and designing on how to fabricate the Green Table. Various designs and related projects are perused and studied to come up a design that would materialize the study. After the final design has been conceived, details and measurements are incorporated in the drawings. Then the fabrication procedure, a series of tests is conducted and minor corrections are done. Process and operations are documented to support the study. When no defects are found, the finalization of the Green T is conducted and data from the evaluation are analyzed and tabulated.

As a Clean Energy Harvester

The chart represents the average performance of the Permanent Magn*et al*ternator as to the Voltage (V) output, Current (A) output and Power (W) output after the test ride of the fifty three (53) respondents who are composed of twenty two (22) male respondents and thirty one (31) female respondents

Results and discussion

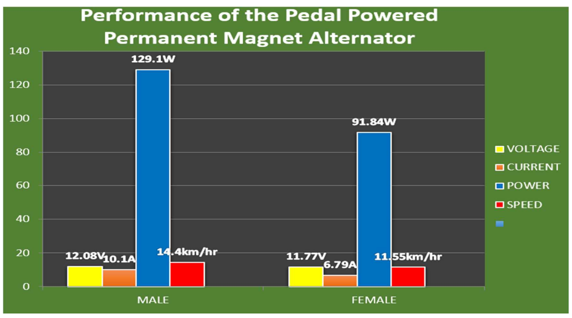

Chart 1. Performance of the pedal powered Permanent Magn *et al.* ternator.

Chart 1, shows the average performance of the Pedal Powered Permanent Magn*et al*ternator for male users with a voltage of 12.08 volts; the current is 10.1 amperes and the power is 129.1 watts and the average speed is 14.4 kilometer per hour. For the female users, the average voltage is 11.77 volts where the average current is 6.79 amperes and the average power is 91.84 with an average speed of 11.55 kilometer per hour.

The study presented in this aimed to investigate the performance of a pedal-powered permanent magn*et al*ternator compared to solar energy as a means of generating electricity for small-scale applications. The results showed that the pedal-powered permanent magn*et al*ternator produced higher voltage, current, power, and speed than the solar panel.

This indicates that human energy can be a more advantageous and sustainable source of energy in certain circumstances. The findings of this research are consistent with other studies that have shown the potential of pedal-powered generators in generating electricity for small-scale applications such as lighting, communication devices, and low-power appliances (Carr, 2017; McDonnell & Amatya, 2016; Ramanujam & Ramkumar, 2017). Furthermore, the study also demonstrated the potential health benefits of pedal-powered generators as it can serve as a form of physical exercise that can help individuals burn more calories than they would while being sedentary.

In terms of limitations, the study only focused on a small sample size and did not account for factors such as the weight and fitness levels of the participants. Furthermore, the study only compared the performance of the pedal-powered permanent magn*et al*ternator to a single 100 W solar panel, which may not be representative of other types and sizes of solar panels. The study provides valuable insights into the potential of pedal-powered generators as a sustainable and cost-effective means of generating electricity for small-scale applications. Further research can be conducted to explore the feasibility and scalability of this technology in various settings and applications.

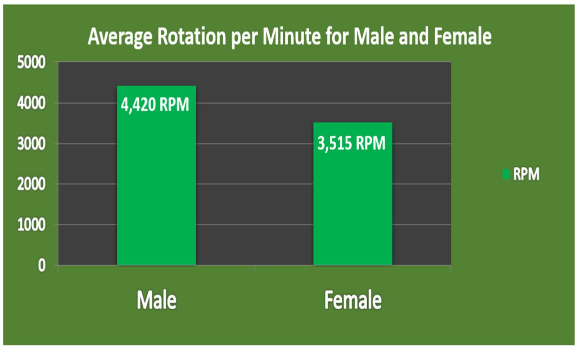

Chart 2. The average rotation per minute for male and female.

The average Rotation per minute of the permanent magn*et al*ternator. Male user has an average RPM of 4,420 which is equivalent to 14.4kmh using the Tachometer, while the female user has an average RPM of 3,515 which is equivalent to 11.55 kmh using the tachometer. The results from Chart 2 indicate that there is a difference in the average rotation per minute (RPM) of the permanent magn*et al*ternator between male and female users. Specifically, male users have an average RPM of 4,420, while female users have an average RPM of 3,515.

This difference in RPM can be attributed to several factors, including differences in physical strength and technique in pedaling the bike. There are several studies that have investigated the performance of pedal-powered generators, including permanent magn*et al*ternators. For example, a study by Shi *et al.* (2020) examined the performance of a permanent magn*et al*ternator attached to a bicycle, and found that the output voltage and power increased with an increase in pedaling speed. Another study by Kato *et al.* (2018) investigated the use of a pedal-powered generator in a disaster relief context, and found that the generator was able to provide a reliable source of electricity for charging mobile devices.

The results from Chart 2 suggest that there is a difference in the average rotation per minute of the permanent magn*et al*ternator between male and female users. Further research is needed to better understand the factors that contribute to this difference, and to optimize the performance of pedal-powered generators for various applications.

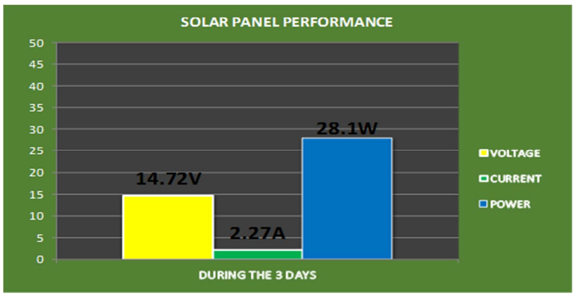

Chart 3. Performance of the solar panel

Chart 3, shows the performance of the 100 W Solar Panel for three (3) days monitoring depicts that it produces an average of 14.72 volts, 2.2amperes current and 28.1 watts of power. The study presented in Chart 3 evaluated the performance of a 100 W Solar Panel over a period of three days. The results showed that the solar panel produced an average of 14.72 volts, 2.2 amperes current, and 28.1 watts of power. These findings suggest that the solar panel is capable of generating a significant amount of power and can potentially be used to power various applications. Several studies have been conducted to investigate the performance of solar panels. For instance, a study by Ahmad *et al.* (2020) evaluated the performance of a 100 W solar panel in a tropical climate. The results showed that the panel produced an average power of 87.3 W with an efficiency of 12.2%. Similarly, a study by Rincón-Mejía *et al.* (2021) investigated the performance of a 200 W solar panel under different weather conditions. The findings showed that the panel produced an average power of 165.4 W with an efficiency of 14.5%.The findings of the present study are consistent with previous research and suggest that solar panels are a promising source of renewable energy. Based on the recorded data using the DC Multi-meter, it implies that the pedal powered permanent magn*et al*ternator which is powered by human energy is more advantageous over solar energy.

As an Exerciser

Calories Burned for Green T Male users in (5) minutes test-run

Prior to the test-run, male and female respondents profile such as weight, height, age, physical activities, and their maximum heart rate (MHR) was computed based on their age and recorded their resting heart and actual heart rate after the test-run using a recorded fingertip pulseoximeter. Their calories burned were computed using the Keytel *et al.* (2005) formula below

Formula for Calories Burned

(for male)

[(Age x 0.2017 – Weight (lbs) x 0.09036) + (Heart Rate x .6309 - 55.0969)] x 5 mins / 4.184

Formula for Calories Burned

(for female)

[(Age x 0.074 – Weight (lbs) x 0.05741) + (Heart Rate x 0.4472 - 20.4022)] x 5 mins / 4.18

This method of computing calories burned is consistent with previous studies that have used heart rate monitors to estimate energy expenditure during physical activity (Achten & Jeukendrup, 2003; Sevits *et al.*, 2013). The use of a fingertip pulseoximeter to record the heart rate of the users is also a valid and reliable method of measuring heart rate during physical activity (Beatty *et al.*, 2014; D'Silva *et al.*, 2016).The use of the Keytel *et al.* (2005) formula and a fingertip pulseoximeter to measure the calories burned by the Green T users is a valid and reliable method in estimating energy expenditure during physical activity. These formulas were converted into excel application for ease of data computation.

Table 3. Average calories burned for male and female users.

Number of Users	Physical Activity	Average Age	Average Weight	Average Heart Rate	Average Calories Burned	Average Calories Burned
Female			(lbs)	(after)	(in 5 minutes)	Per Minute
31	Only two (2) respondents are Physically Active	41	132	105	26.33	5.26
Male			(lbs)	(after)	(in 5 minutes)	Per Minute
22	Only one (1) respondent is Physically Active	40	149	113	60.93	12.19

Note: Average calories burned/minute of sedentary individual (Wilson, 2017)

Female: 1.39/minute and Male:1.74/minute

Table 3 provides information on the average calories burned by male and female respondents who participated in the study. The table shows that only one male respondent and two female respondents were physically active during the 5-minute test run. The results indicate that the physically active male respondents burned an average of 60.93 calories per minute, while the physically active female respondents burned an average of 26.33 calories per minute. These results demonstrate that being physically active can significantly increase the number of calories burned in a short amount of time. The table also compares the average calories burned per minute by the physically active respondents to the average calories burned per minute by sedentary individuals. According to Wilson (2017), a sedentary male burns an average of 1.74 calories per minute, while a sedentary female burns an average of 1.39 calories per minute. The results of the study indicate that the physically active male respondents burned 10.45 times more calories per minute than sedentary males, while the physically active female respondents burned 18.96 times more calories per minute than sedentary females. These findings are consistent with previous research that has demonstrated the positive effects of physical activity on energy expenditure and weight management (Blaak, 2001; Jakicic *et al.*, 2001). The results of the study provide further evidence of the importance of engaging in regular physical activity for maintaining a healthy weight and reducing the risk of chronic diseases.

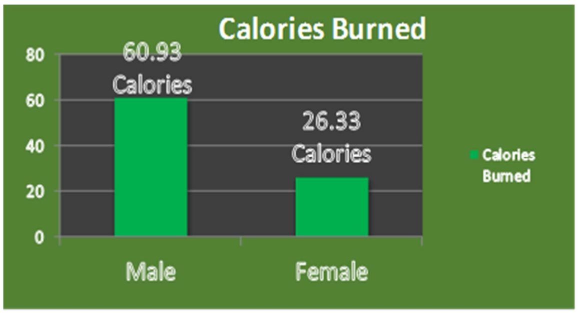

Chart 4. Average calories burned for male and female

Chart 4 shows the average calories burned of the Green "T" users, which is 60.93 calories for male and 26.33 for female. The finding from Chart 4 indicates that male users of the Green "T" burned more calories compared to female users. This result is consistent with previous studies that have shown that males generally burn more calories than females during exercise due to differences in body composition and metabolism (Schoeller *et al.*, 1986; Goran *et al.*, 1994).

Regular physical activity, such as pedaling the Green "T", has been shown to have numerous health benefits including reducing the risk of chronic diseases, improving mental health and cognitive function, and promoting overall well-being (Physical Activity Guidelines Advisory Committee, 2018). Therefore, the Green "T" can be a useful tool for individuals to achieve their recommended daily physical activity goals.

Conclusions

Based on the findings of the study, the following conclusions are drawn:

1. Based on the design, the Green T is durable and doable within the range of the technology practitioners and moreover, it is economical compared with commercialized executive tables.
2. The materials for the Green "T" are all locally available and are fit for the purpose.
3. The electro-mechanical components function together when properly assembled where they are also compatible to each other.
4. It is concluded that male users burn much calories compared to female users because male users pedal much stronger and faster compared to female users.
5. The male users generate more power voltage output and current output than female users because male pedal more and stronger than female.
6. Considering all the supplies and materials like labor cost and miscellaneous expenses, the Green T is worth a total of Php 41, 817.50 in which the amount is just minimal to produce an executive table, solar panel, battery to power the system.

Recommendations

Based on the findings and conclusions of the study, the Researcher recommends the following:

1. Investigate the potential of the Green T in reducing the carbon footprint of households and offices and its contribution to mitigating climate change.

2. Conduct a comparative study of the energy output and efficiency of the Green T with other clean energy harvesting systems.
3. Examine the impact of using the Green T on the health and productivity of sedentary office workers, including its potential to reduce absenteeism and increase job satisfaction.
4. Conduct a feasibility study on the scalability of the Green T and its potential for mass production and distribution in both developed and developing countries.
5. Explore the potential of the Green T in promoting sustainable tourism and the development of sustainable communities, including its use in eco-friendly resorts and hotels.
6. Investigate the possibility of integrating the Green T with smart home technology, such as home automation systems and energy management systems, to optimize its energy output and promote energy efficiency.
7. Assess the potential of the Green T in reducing energy poverty in off-grid communities and disaster-affected areas, including its use in emergency response and disaster management.
8. Conduct a longitudinal study on the durability and maintenance of the Green T over an extended period of time to determine its lifespan and potential for long-term use.
9. Investigate the potential of the Green T in promoting sustainable transportation, such as using it to power electric bicycles or electric vehicles.
10. Explore the possibility of using the Green T in educational settings, such as schools and universities, to promote healthy lifestyle habits and sustainability awareness among students and staff.

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