



POWERGYM: POWERING THE FUTURE WITH HUMAN WORKOUT ENERGY

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Abstract: The POWERGYM project expects to rethink how energy can be gathered, investigating the capability of human exercise routine schedules as an environmentally friendly power source. This task uses energy-reaping advancements incorporated into rec center hardware, intended to catch and change motor energy from practices like cycling, yoga, and pull-ups into power. POWERGYM presents a double-reason approach: advancing individual wellness while adding to the spotless energy supply. By adjusting exercise center gear with energy-catch advances, such as piezoelectric yoga mat sensors, dynamo frameworks in exercise bikes, and energy-saving components, this drive blends individual health with ecological obligation. The energy produced by people's exercise endeavors might drive rec center lighting, gear, and electronic gadgets, or be put away for some time in the future, adjusting individual well-being objectives to the more extensive cultural push for economical energy sources. POWERGYM eventually addresses a dream for green wellness offices focusing on human well-being and ecological stewardship.

Keywords: Human energy generation, Gym pull-up, yoga mat, cycling, Renewable energy, Sustainable fitness, Kinetic energy harvesting, Exercise power age.

I. INTRODUCTION

There is a pressing need for viable and efficient alternative energy sources as a result of the rapid expansion of metropolitan areas, increasing population density, and rising energy consumption. Customary energy sources are often restricted, non-sustainable, and contribute essentially to natural debasement. The possibility of using human energy from exercise as a long-term resource has gained attention as more people adopt well-being-focused lifestyles and the number of center participants continues to rise. POWERGYM plans to transform proactive activities like cycling, yoga, and pull-ups into usable energy using a cutting-edge drive in the wellness and energy fields. This idea isn't just imaginative but additionally lines up with the developing longing for maintainability and individual well-being. The reason behind POWERGYM is moderately basic however creative: by changing the motor energy delivered during exercises into electrical energy, we can offer an inexhaustible, eco-accommodating energy source. Since exercise center

exercises are a known, predictable source of force, they are ideal for energy capture innovation. Coordinating energy-collecting components into exercise center hardware could create huge measures of power, changing exercise centers into miniature power stations. A decentralized and inexhaustible power source, this energy could be used to control exercise center offices, add to nearby lattices, or supply encompassing metropolitan frameworks.

II. RELATED WORK

Energy and human's capacity to change energy into helpful work has been the foundation of the improvement of civic establishments. The majority of human life is spent entirely reliant on the metabolic energy provided by plants and animals. In years and years, society has changed, from depending on substantial energy to turn out to be primarily subject to petroleum products[1]. The ignition of hydrocarbon energy assets unfavorably affects our current circumstance, which has started a push for clean energy. This exploration study investigates the metabolic energy result of people, explicitly inside an activity office, to assess the plausibility of electrical ability to be supported by human-fueled energy. Two paddling exercises were assessed and afterward contrasted with sun-based photovoltaic as an option for environmentally friendly power [2]. The study's results show that 40 people with different actual abilities can work together to provide 3-5% of the exercise center's typical daily power interest at a productivity of 64% [3]. In the present era, many devices are available for energy harnessing such as electromagnetic, electrostatic, and piezoelectric generators, and these devices are designed based on their ability to capture different forms of environmental energy such as solar energy, wind energy, thermal energy and convert it into the useful energy form [4]. Out of these devices, the use of a piezoelectric generator for energy harvesting is very attractive for MEMS applications. For the purpose of energy harvesting, researchers use waste heat, solar and wind energy, energy from floating water, and mechanical vibrations as sources of harvestable energy. The dynamo receives the rotational movement and spins to generate power. A spring component that stores and transfers energy during the draw-up movement can be added to the framework to enhance its effectiveness [5]. This considers a smoother and more predictable age of power, in any event, during times of shifting client exertion. Additionally, the electrical energy created by the dynamo can be used to control different gadgets or apparatuses, like Drove lights. This exhibits the pragmatic utilizations of the framework, displaying its true

capacity for giving feasible energy arrangements in true scenarios. Overall, this undertaking features the capability of human-controlled energy age as a feasible and eco-accommodating option in contrast to conventional power sources [6]. By tackling the energy produced from ordinary exercises like activity, we can add to the change towards cleaner and more reasonable energy frameworks. The reasonable applications, energy-gathering areas, and materials utilized for energy collecting are presented. Besides, the functioning standards, attributes, and difficulties related to various energy trade techniques, as well as elective methodologies, are summed up. In addition, the basic advances of energy-reaping gadgets are broken down as far as their combination with the biomechanics of human movement, improvement of energy collecting effectiveness, and scaling down of plan [7]. At last, the future advancement of energy-gathering gadgets is talked about, including possibilities for energy capacity, effective transformation, and more refined energy-collecting techniques. It looks at the monetary, natural, and social advantages of consolidating environmentally friendly power advancements, including human-fueled generators, in the center foundation [8].

III. PROBLEM STATEMENT

Traditional energy sources are proving to be insufficient and unreasonable in the face of rising global energy demands and growing environmental concerns. Techniques that are quirky but encouraging have been the focus of the search for clean, long-lasting power sources. Millions of people visit wellness centers and wellness centers to tap into a previously untapped source of long-term power through the dynamic power generated by actual activity. Presently, the energy used in these spaces goes unutilized, squandering potential energy that could be tackled to lessen carbon impressions. The POWERGYM project resolves this issue by creating frameworks to catch and change the energy delivered during exercises, like cycling, yoga, and opposition preparation, into usable power. The goal of this strategy is to promote a wellness culture that is eco-conscious and produces energy while simultaneously reducing the centers' reliance on conventional power sources.

IV. PROPOSED METHODOLOGY

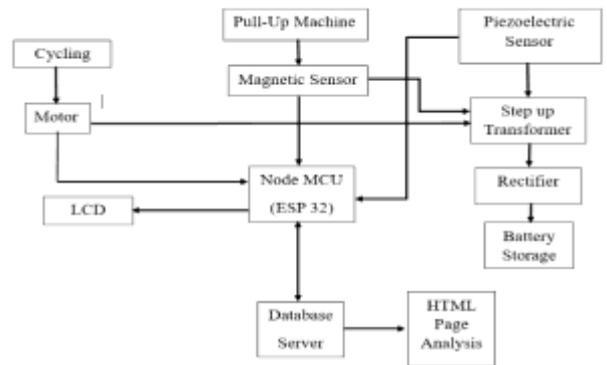
- 1) *System Design:* Define the overall system architecture, including the components required for power generation. Design the mechanical structure to support the gym pull-up, Yoga Mat, and Cycling setup, ensuring stability and safety. Bikes are equipped with dynamo systems that convert mechanical energy from pedaling into electrical energy. Each cycle is designed to maximize energy efficiency, with minimal resistance added to the users pedaling.
- 2) *Component Selection:* Select a suitable dynamo capable of generating electricity from rotational motion. A rectifier circuit stabilizes and converts the generated AC power to DC, suitable for storage or direct usage.

Fig 1: Block Diagram

- 3) *Installation and Integration:* Integrate the dynamo and gear system with the gym pull-up bar and other structural elements. Special yoga mats are embedded with piezoelectric sensors that capture energy from

applied pressure during poses. Piezoelectric materials generate electrical energy through pressure-induced mechanical strain, ideal for low-impact exercises.

- 4) *Electrical Connection:* Centralized Storage Hub: Each piece of equipment is connected to a central energy storage unit, typically a battery pack capable of



receiving and storing DC power.

- 5) *Performance Evaluation:* Evaluate the power generation capabilities of the system by measuring output voltage, current, and power. Analyzing the final output using Software.

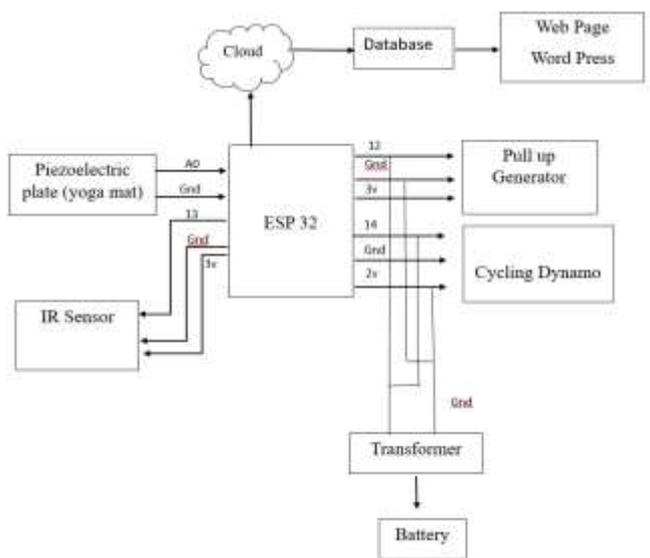


Fig 2: Circuit Diagram

V. WORKING MECHANISM

1. Energy Generation Components

- Pull-Up Machine: Converts mechanical strain from pull-up exercises into electrical energy.
- Piezoelectric sensors generate a voltage when subjected to stress.
- Cycling (with Magnetic Sensors):
 - Utilizes a magnetic sensor to convert the rotational motion from cycling into electrical energy. A dynamo or similar mechanism may be part of this system to enhance energy capture.

2. Energy Processing Components

- Rectifier:



- Converts the alternating current (AC) produced by the sensors or dynamos into direct current (DC) for compatibility with storage and electronic components.

- Step-Up Transformer:

- Boosts the voltage to an appropriate level for storage or utilization. This ensures sufficient energy is delivered despite variations in exercise intensity.

3. Control and Display

- Node MCU (ESP 32):

- Acts as the microcontroller, managing data communication and interfacing between sensors, storage units, and the user interface. It collects data from the sensors and ensures proper system operation.

- LCD Display:

- Provides real-time feedback on energy-generated workout performance, offering users immediate insights into their contributions.

4. Energy Storage and Management

- Battery Storage:

- Stores the processed energy for later use. This ensures energy generated during workouts can be used even when physical activity has stopped.

5. User Interface and Connectivity

- HTML Page Analysis & Database Server:

- An HTML-based interface is likely hosted by the Node MCU or an external server, providing a dashboard where users can view data such as workout statistics and energy contributions. The database server stores historical data for analysis.

6. Output Utilization

- Motor:

- Converts the stored electrical energy into mechanical energy to power other equipment or applications.

- Connected Devices:

Fig 3: Circuit Rig up

- The system may also provide power to small electronics or external systems, showcasing the practical application of workout-generated energy.

VI. RESULT

When a force, pressure, vibration, or strain is applied to the material, it deforms or compresses. The deformation causes an internal displacement of positive and negative charges within the crystal lattice, creating an electrical potential difference. The generated voltage is proportional to the applied mechanical force and can be captured through electrodes attached to the material.



Fig 3: Voltage generated by yoga mat

Cycling can generate voltage using a **motor** and monitor the cycling motion with a **reed switch magnet sensor** for counting revolutions and optimizing energy output. The pedaling action of the cyclist rotates the bicycle's wheel, which is mechanically connected to the shaft of a DC motor or generator. As the motor's rotor spins, it cuts through the magnetic field created by its internal magnets or windings, inducing a voltage in the motor's coil (according to Faraday's Law of Electromagnetic Induction). This data can optimize the energy conversion process or provide feedback to the user.

Fig 4: Voltage generated due to cycling

When we combine all the AC voltage produced by the Piezoelectric sensor(yoga-mat) and motor (pull-up and pedaling) mechanism this voltage is rectified into DC voltage using a rectifier and then it is passed to step up transformer where increases of voltage from lower level to higher level take place. The voltage produced by the transformer which is stored in a rechargeable battery for future use, and the amount



of voltage produced by PowerGym is analyzed using a graph for better inspiration for youths by collecting data from the server, when we block IR sensor which acts as a switch for the server and model.



Fig 7.4 Analysis based on data from the server

VII. FUTURE SCOPE

A model that addresses human exercise energy for the power age has a lot of potential for the future, especially in a time when manageability and sustainable power are becoming increasingly important. This creative methodology could stretch out past conventional exercise center settings to public spaces, schools, and homes, coordinating energy-reaping advancements into regular exercises and wearable gadgets. As shrewd exercise center advances and IoT availability creates, clients could screen their energy commitments progressively, encouraging commitment through gamification and prizes. Advances in energy capacity systems, such as superior batteries and supercapacitors, will make it possible to efficiently capture and use energy, possibly allowing an excess of energy to be managed once more into the matrix. Moreover, the commercialization of this model can prompt exceptional businesses to open doors for wellness focuses, lining up with corporate wellbeing programs and advancing ecological mindfulness among clients. The model will not only enhance customer experiences as research into additional productive materials and half-breed frameworks advances, but it will also significantly contribute to global supportability initiatives, enabling a better way of life and producing environmentally friendly electricity. Generally, this idea holds the possibility to change how we view wellness, energy utilization, and natural obligation in our regular routines.

VIII. CONCLUSION

In conclusion, the "PowerGym: Powering the Future with Human Workout Energy" framework addresses a promising combination of wellness, maintainability, and innovation. By saddling the mechanical energy created during center draw-up works out, the framework offers a sustainable wellspring of power while advancing actual work and ecological cognizance. Despite its benefits, including maintainability, medical advantages, and adaptability in the application, the framework likewise presents difficulties like energy effectiveness, upkeep prerequisites, and forthright expenses. Tending to these difficulties will be vital for guaranteeing the drawn-out reasonability and progress of the framework in different settings, including wellness focuses, restoration offices, instructive establishments, corporate wellbeing projects, and public spaces. Overall, the "PowerGym: Powering the future with human workout energy" framework addresses a stage towards a more manageable and dynamic way of life, exhibiting the capability of a human-fueled

energy age to add to a greener and better world. As we investigate and develop in this field, it is basic to focus on supportability, openness, and client commitment, driving positive change in wellness and natural practices.

In the proposed hypothetical model, it is reasoned that individuals use energy during gym practice to consume their calories to accomplish their ideal wellness level can be changed over and put away in batteries as electrical energy. The Power center hardware will change over human endeavors into electrical energy which in any case gets squandered. It will help in tracking down new wellsprings of environmentally friendly power and help us to defeat the energy emergencies that we are confronting and expand in a worldwide temperature alteration that we are looking to expand utilization of non-environmentally friendly power hotspots.

IX. REFERENCES

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