Energy generation and performance matrics from piezoelectric smart speed bag

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INTRODUCTION

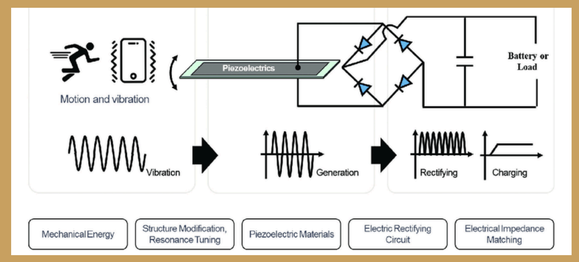
The pursuit of effective training tools for boxers and martial artists has led to an increased focus on technology integration. Traditional speed bags provide an excellent workout for hand-eye coordination, speed, and rhythm. However, they often lack advanced features that can enhance training efficiency and user engagement.This project outlines the integration of piezoelectric technology into speed bags to harvest energy and track performance metrics, offering significant value to athletes.

OBJECTIVE

The primary goal of this project is to develop a speed bag equipped with piezoelectric sensors that can convert impact energy into electrical energy while simultaneously monitoring the number of hits per second. This dual functionality enhances the training experience, providing realtime feedback and promoting sustainability through energy harvesting.

METHODOLOGY

1. Design and Prototyping: Ensure optimal placement of sensors for accurate impact detection.
2. Energy Harvesting System: Design a rectifier circuit to convert the piezoelectric output to usable DC power.
3. Performance Tracking System: A real-time hit counts and a data logging system for performance analysis.
4. Testing and Calibration:Conduct field tests with athletes to calibrate sensors and refine the energy harvesting system



MATERIAL REQUIRED

Piezoelectric sensors
Microcontroller
Bridge Rectifier and Filter circuit
Power bank / Battery
Punching bag / Speed bag

APPLICATION

1. Enhanced Athletic Training Feedback
2. Sustainable Energy Harvesting in Sports
3. Interactive Fitness for Gyms and Home Use
4. Rehabilitation and Physical Therapy Support
5. Youth Engagement and STEM Education
6. Sports Science Data Collection and Analytics
7. Gamified Fitness and Competitive Challenges

OUTCOMES

The project outcomes include enhanced athletic training with real-time feedback, promoting eco-friendly practices through energy harvesting, and supporting both rehabilitation and gamified fitness experiences. Additionally, it encourages youth interest in STEM and offers valuable data for sports science research. Together, these aspects create an engaging, sustainable, and educational training tool.

Outcomes

1. Increased Athlete Performance: Immediate feedback on speed and accuracy allows athletes to see tangible improvements over time, helping them to build confidence and refine their techniques in real-world training.
2. Reduced Environmental Impact: By generating and storing its own energy, the device lessens the need for disposable batteries, minimizing waste and offering a more sustainable training option for users and gyms.
3. Improved Patient Rehabilitation: With consistent, measurable progress tracking, the device supports rehabilitation centers by enabling therapists to monitor and adjust recovery plans effectively for patients.
4. **Educational Value for Young Athletes**: By connecting sports to energy science and data analysis, the device provides a learning experience that can spark interest in STEM among young users, bridging physical activity and academics.

COST

Item	Cost
Piezoelectric Sensors	1850
Microcontroller	1250
Rectifier Circuit Components	990
Battery	1500
Speed Bag	980
Unexpected cost	600
Total Estimated Cost	7170