



**The Nazarene Catholic School**  
(Quiapo Parochial School)  
1053 R. Hidalgo St., Quiapo, Manila

# **MINI TASK 2 and PERFORMANCE TASK**

## in General Physics 2

**Submitted by:**

Alviar, John Angelo R.  
Bayani, Hazel Ann A.  
Camacho, Rochelle Mae B.  
Conti, Coleena Mitzi S.  
Jurilla, Shaiana V.  
Perreras, Princese Angel P.  
Seña, Alexie Andrea D.

Grade 12 – Archdiocese of Manila (STEM)

**Submitted to:**

Ms. Kimberly Cantos

March 05, 2022



# The Nazarene Catholic School

(Quiapo Parochial School)

1053 R. Hidalgo St., Quiapo, Manila

## I. TITLE

ETire - Piezoelectric based tires

## II. CONTENT

### A. Rationale

The Philippines has a large number of transportation vehicles. Different modes of transportation are available, such as cars, buses, light rail transit (Lrt), tricycles, jeepneys, and more. According to [bworldonline.com](http://bworldonline.com), an estimated 2.7 million vehicles wander the streets of the Philippines every day. Aside from that, there are certain houses in the Philippines that do not have electricity or those that are prone to power interruptions. As a consequence of these common events, researchers discovered a feasible alternative. They proposed a vehicle with a specific function on its wheels, which may be utilized for more than simply a typical means of transport. These vehicles will produce energy that may be utilized to create electricity, providing all Filipinos affected by the rolling blackouts with a source of energy. In this way, they would not only alleviate Filipinos' troubles, but also significantly improve matters with more advanced features. It could be quite convenient for the individuals who are able to consume and benefit from the electricity generated.

Moreover, as the economy continues to expand and grow, so does the need for energy resources. As demand rises, we can't deny the fact that there will be a time wherein we worry about the depletion of resources employed to create energy in a conventional manner. It is because, in today's modern world, society is developing new innovative non-conventional approaches that are gaining popularity. Therefore, piezoelectric materials and reactions, which yield electrical energy when subjected to mechanical strain, will play a significant role in resolving this problem. The researchers will be producing and storing charge in the vehicle's wheels by using piezoelectric in the tires because it will allow them to incorporate it in numerous automotive industries too. Most significantly, it reduces power concentration while activating and sustaining the most untouched and remote sectors of a region. While we save money by using these power-generating tires, we lessen environmental pollution by reducing our dependence on thermal electricity. Electricity can then be used to power other devices or stored for later use.



## The Nazarene Catholic School

(Quiapo Parochial School)

1053 R. Hidalgo St., Quiapo, Manila

### **B. Overview**

#### **1. Description of the structure**

An "E-Tire" is the kind of product that the researchers have envisioned. This project is not just any ordinary wheel that you can see on the road; its product is built from a pneumatic tire that is piezoelectric in nature. Piezoelectricity is the property of a material, such as a pneumatic tire, something that allows anything to create an alternating current voltage when exposed to mechanical stress or vibration. The piezoelectric materials will be applied to the pneumatic tire. As that material is compressed, it may establish a voltage across two of its faces. To be more precise, whenever the wheel moves or spins, the piezo cell that is implanted in the product becomes constrained, releasing stress and generating electric signals. Therefore, physical deformation of piezoelectric material would transform mechanical energy to electrical energy and vice versa. The product should then be built with a pneumatic tire wheel, rubber, a piezo cell, an absorber spring, and, of course, the piezoelectric material.

#### **2. Type of energy source**

Piezoelectric materials are resources that can generate electricity when mechanical stress is applied to them. Quartz is a well-known piezoelectric material. The process includes the formation of an electric charge as a result of electron migration in response to stress. When subjected to dimensional change produced by strain, a piezoelectric material with a non-centrosymmetric crystal structure could create displacement between anions and cations, forming a surface charge. In doing so, it will work effectively as a sensor in a wide range of applications, including vibration monitoring, impact detection, and ultrasonic reception sensors.

#### **3. How will it generate its own electricity?**

This project, ETire intends to pursue an alternative way of harnessing energy by utilizing piezoelectric materials. Piezoelectric materials are those that can generate electric energy when mechanical stress is applied to them. It generates electricity even when the car is driving. According to Xavier Fraipont, tires are constantly being deformed as they spin, so why not put that to good use? The idea is using this material all over the tire to produce energy whilst driving.



## The Nazarene Catholic School

(Quiapo Parochial School)

1053 R. Hidalgo St., Quiapo, Manila

### III. REFERENCES

- Gonzales J. 2018. How many vehicles pass through EDSA everyday? BusinessWorld. Available from <https://www.bworldonline.com/how-many-vehicles-pass-through-edsa-each-day/>.
- Makki N, Pop-Iliev R. 2011. Piezoelectric power generation in tires. SPIE. Available from <https://spie.org/news/3702-piezoelectric-power-generation-in-tires>.
- Bhagabati P, Rahaman M. 2022. Structure-property relationship in polymer-graphene composites. Rahaman M, Nayak L, Hussein IA, Das NC, editors. ScienceDirect, p. 299-315. Available from <https://www.sciencedirect.com/science/article/pii/B9780128216392000161>.
- Zhu R, Wang Z. 2020. 9 - Piezoelectric one to two-dimensional nanomaterials for vibration energy harvesting devices. Tao L, Akinwande D, editors. ScienceDirect, p. 221-241. Available from <https://www.sciencedirect.com/science/article/pii/B9780128183861000096>.
- Davies A. 2015. Goodyear Is Trying to Make an Electricity-Generating Tire. Wired. Available from <https://www.wired.com/2015/03/goodyear-trying-make-electricity-generating-tire/>.
- Piezoelectric Material - an overview | ScienceDirect Topics. 2020. ScienceDirect. Available from <https://www.sciencedirect.com/topics/materials-science/piezoelectric-material>.