

Hwa Chong Institution
Project Work
Category 3
Inventions Log Book
(Revised for 2020)

Title of Project: <u>Project PSFL</u>
Group Name: Project PSFL
Group Members: 1)Keagan Njoman 2)Wang Xincheng 3)Fan Shao Cong 4) -None-

1. Problem Finding

(The beginning...)

Identify a problem you would like to solve. You may want to brainstorm for problems using different approaches eg thematic, survey or general brainstorming etc.

1 A Document a list of problems you have identified. Your documentation should show clearly how your group came up with the problems.

Environmental concerns have been a hot topic for a very long time. We decided to research environmental problems about the ocean, and these are the problems we have identified:

- 1) Sea pollution
- 2) Overfishing
- 3) Destruction to wildlife

1 B You should have selected a problem based on some considerations. Identify and justify these considerations.

We found it unrealistic to do anything about chemical spills and sea pollution, and we decided to do a project based on an underlying problem we have found about overfishing. It is something that does not require large scale research, and is realistic for us to do. We decided to do our research based on this problem, and we found that coastal fishermen are being affected by this.

1 C List some problems your group would like to solve. List also the considerations for selection of problems in the evaluation grid below. Score the considerations, against the problems, with points 1 (least significant) to 4 (most significant). Sum up the total points for each problem. Identify that problem you would like to solve.

Problem Evaluation Grid

*add more columns and rows where necessary

Considerations for Selection (10 points each)	Problems		
	#1 Sea pollution	#2 Coastal fishermen not getting enough fish	#3 Destruction to wildlife
Consideration 1 Is the problem solvable?	4	8	4
Consideration 2 Is the problem worth solving?	9	9	9
Consideration 3 Is this a relevant problem?	9	9	8
Total Score	22	26	21

2. Define the Problem (This is one...)

Now that the problem has been identified. It is important to gather information on the extent of the problem and/or evaluate the usefulness of existing solutions based on *some criteria*. You may need to conduct surveys and research on existing solutions.

2 A Extent of problem (Research and discuss the problem and write down the problem statement)

After researching, we found out that some poor coastal fishermen are facing problems such as:

- Depletion of fishes
- Low catch of fishes

On top of that, we also found out that commercial fishing is not environmentally friendly, due to overfishing and destructive fishing methods that harm the environment, such as blast fishing, cyanide fishing and bottom trawling.

Hence we have come to a decision that we have to develop a safer fishing method that is able to help coastal fishermen catch more fish while protecting the environment as much as possible.

Summary:

Poor coastal fishermen who do not have access to modern fishing equipment are unable to compete with industrial fishing companies that employ environmentally-destructive fishing methods, and as such, fishermen have to move around to find areas with an abundance of fish manually to fish.

2 B Compare and contrast the existing or similar solutions.

Existing solutions include giving the fishermen more and higher quality fishing gear, but as students would not have the resources to provide that for the fishermen.

Another solution is to build more farms in the village so that fishermen can get more food without even going out to sea but that would take up a lot of space and would be hard to maintain.

3. Your BIG IDEA[#]

(Developing the idea....)

Write down your proposed invention and why you want to do it. State also how you think your proposed invention is better.

3 A Describe your proposed invention.

A piezoelectric-powered green light which converts kinetic energy to electrical energy. The piezoelectricity will be harnessed by using the ocean currents and waves. The green light submerged underwater will be used to attract more fishes for the fishermen, thus yielding a higher catch. A blinking red light will be above the floating platform to inform the fishermen on where the structure is.

3 B Explain the purpose of your proposed invention and the potential benefits to users.

The green light is used to attract more fishes and bring poor coastal fishermen a higher yield of fish, and by using piezoelectricity to power it, it would be maintenance-free, and at the same time it would also be environmentally friendly.

3 C In what ways would your proposed invention be different and/or better than existing solutions, if any?

Our proposed invention would be better than existing solutions because it is much easier to install and pretty cheap too. The existing solutions to provide energy include using wind and solar energy, as well as using batteries.

Wind energy is not really good because it requires specific locations where there is a lot of wind. Due to fishing villages being close to the shores, the wind is usually very unpredictable. Moreover, wind turbines are very expensive to install and take up a lot of space.

Solar energy is also not as good because it only harvests energy in the day and would not work at all at night. Solar panels are also pretty expensive and require large open areas to harvest as much energy as possible.

Batteries to power the light are just not sustainable and expensive, which defeats the purpose of our invention.

Piezoelectricity is much more reliable and is also sustainable, and it also operates 24/7 due to the waves always being in motion causing the piezoelectric strips to bend and harvest energy.

3 D What are some problems you expect in the course of your proposed invention?

It may be expensive in large quantities, but we believe that the long term benefits of this invention outweigh the costs.

3 E What and when are the major milestones (project timeline) in your invention?

The major milestone in our invention is when we finally figured out a way for the piezoelectric strips to bend in the waves anywhere anytime without it having to be anchored or secured onto another surface. This helped us a lot as we do not have to worry too much about certain conditions as the tides rise and fall.

#must be able to be constructed based on current / emerging technologies, must not violate the laws of Science or go against the laws of nature.

4. Proposed Construction or Modelling Process*

(This first... then that...)

You are now onto the fabrication of your prototype/ product. You need to select material and understand how to put them together so that your prototype/ product can perform its function.

4 A Explain how and why the materials were chosen for the prototype/ product of your invention

The materials were chosen based on what is most suitable to build the particular component of the product.

For the floating platform, High Density PolyEthylene (HDPE) was used as it is relatively inexpensive and is able to withstand abrasion, due to the sea waves in constant motion,

moving up and down. As for the floating body, plastic foam is used. Both are light and able to float on water.

The support pillar can be made out of Stainless steel, preferably 316L Marine Grade Stainless Steel as it is durable and corrosion-resistant, as such it is suitable for being used out at sea to hold the platform up. However, if the budget is too low, it can be changed to wood which is less durable but is a much cheaper alternative as compared to 316L Marine Grade Stainless Steel.

The circuit box used to contain the circuit is preferably made out of a waterproof plastic enclosure, to protect the circuit (from short circuits, etc). An artificial coral reef can also be used under the structure which will be made out of concrete and metal.

4 B Explore these considerations that may guide the construction of your prototype/ product.

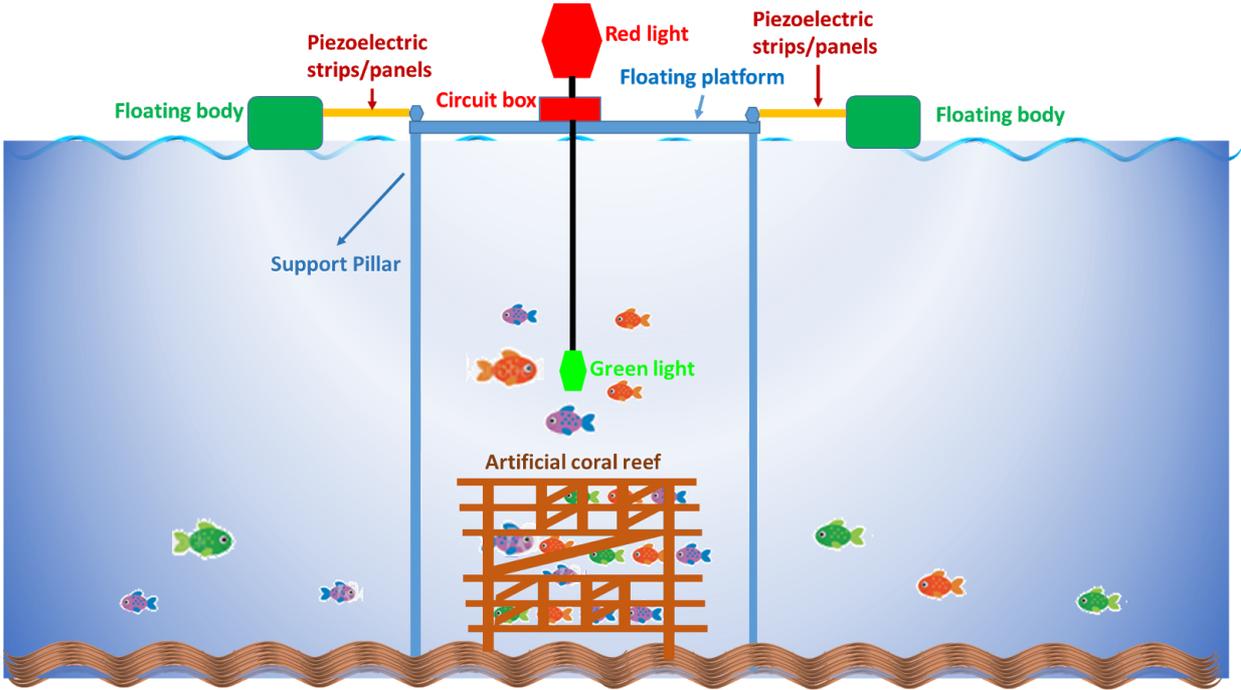
As our product will be designed to function in water, the floating platform has to be strong enough to withstand abrasion from the waves. The floating body is made out of plastic foam so that it can float.

The support pillars have to be strong, corrosion-resistant and durable because it will almost always be submerged in water. Hence Marine Grade Stainless Steel is used. If the cost is too high wood can also be an alternative for the support pillars.

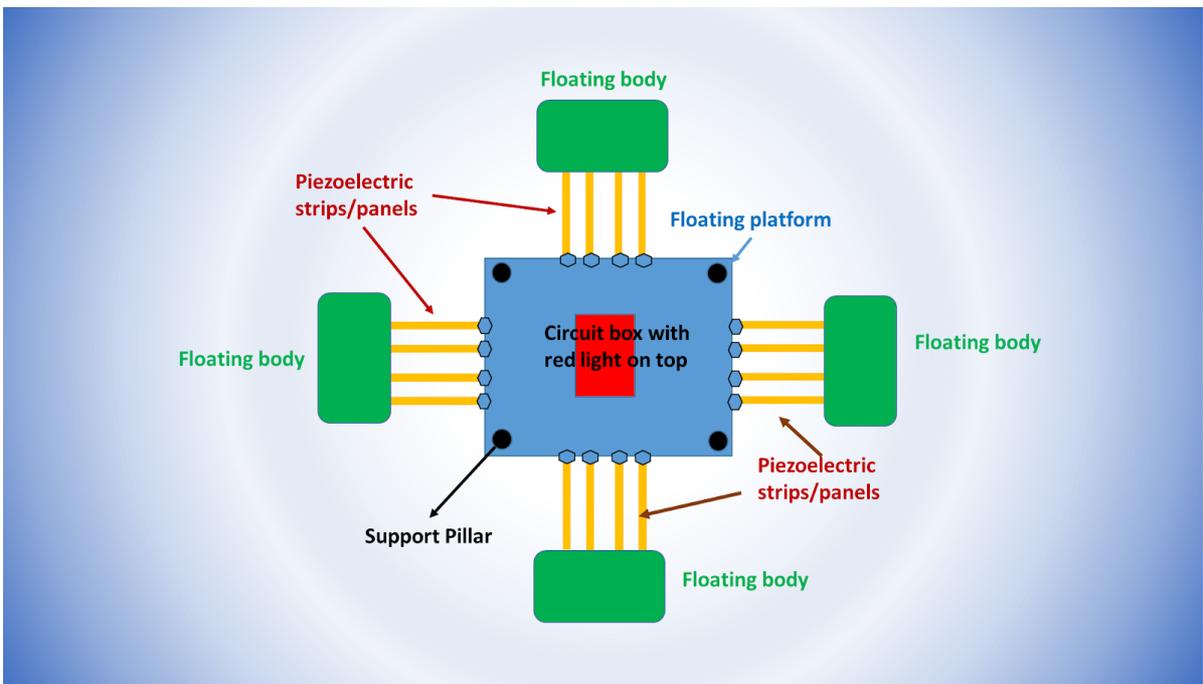
The circuit has to be covered with waterproof material due to it constantly being in contact with water that will cause the circuit to fail.

The artificial coral reef had to be strong and durable which means metal and concrete can be used.

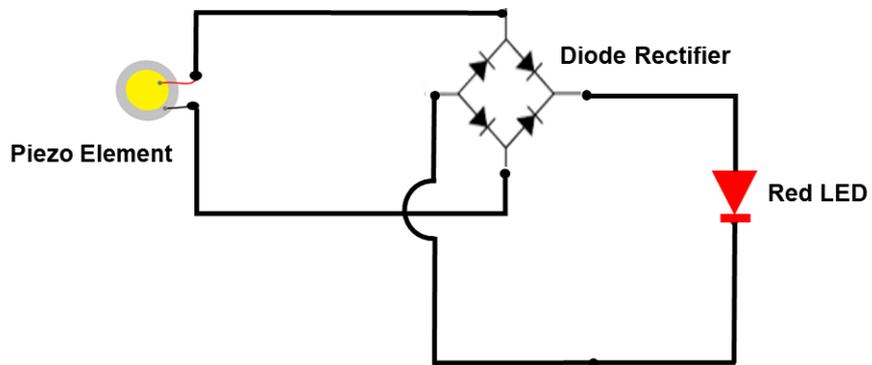
4 C Propose how the prototype/ product will be constructed or developed. You may use drawings and photographs.



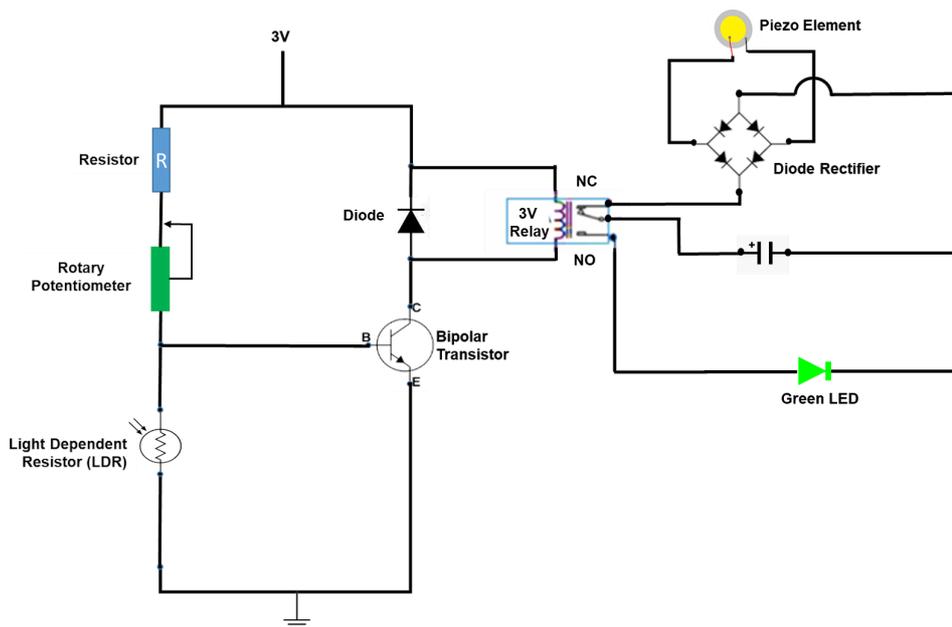
A side view of the product



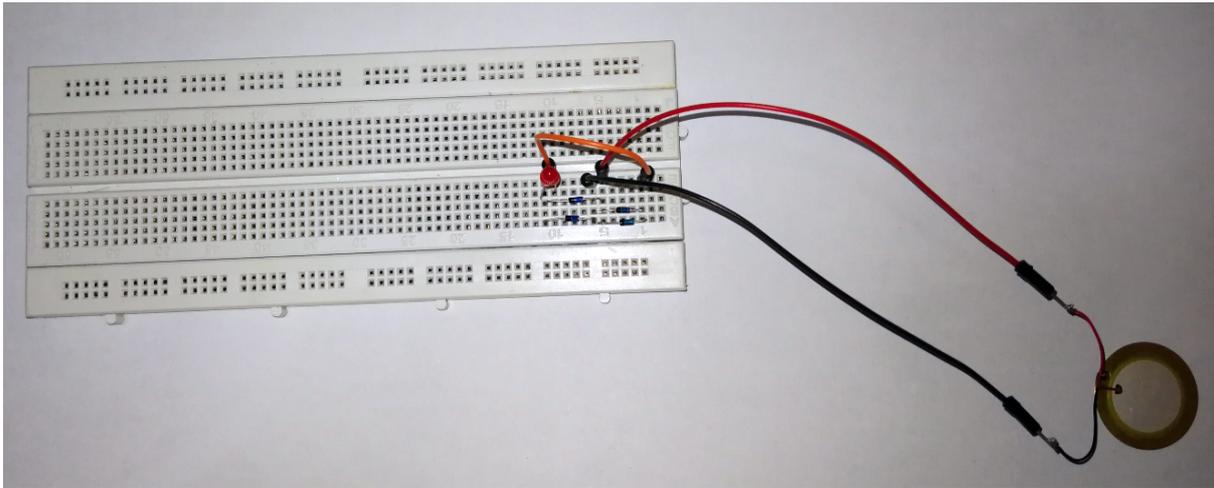
A Top View of The Product



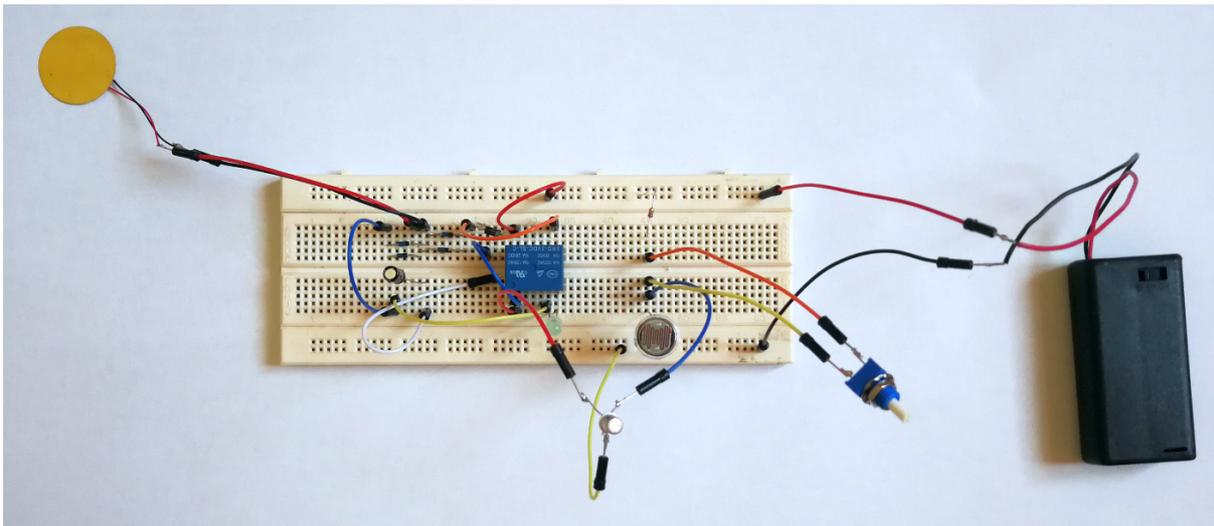
The circuit for the blinking red light



The Circuit for the Green Light



The Circuit for the Red Light on Breadboard



Circuit for Green Light on Breadboard

OR

If the construction of the prototype is not possible, then you have to create an animation / as a proof of concept that it can be applied on a bigger scale.

- 4A Explain why the construction of a prototype is not possible and the proof of concept is needed in your case.**
We could not build a prototype due to the special circumstances this year. However, we were able to show that our circuit was working by building it and testing it out on a breadboard, with video evidence.

4B Briefly explain how the video/animation can effectively show how your invention will work and the different considerations.

First Video for Red Light:

<https://drive.google.com/file/d/1VVHa8FmJcs4WzbQOwh898qTyozoe3I1/view?usp=sharing>

Second Video for Green Light:

https://drive.google.com/file/d/17mgEfqlpSKt34TB4Usl5fTyTI_gBk0tY/view?usp=sharing

(Both videos require HCI email to view)

In the first video, it is shown that by tapping on the piezoelectric element (used to represent the piezo strip) it simulates deflection due to the sea waves in constant, kinetic energy is converted to electrical energy. The electrical current then flows through the diode rectifier which converts the current from an AC current to a DC current. As mentioned above, since the sea is in constant motion, each deflection of the piezo strip will lead to an electrical pulse and the Red LED will blink continuously in the day and at night.

As for the second video, similarly to the first circuit as mentioned above, kinetic energy is converted to electrical energy, the electrical current then flows through the diode rectifier which converts the current from an AC current to a DC current. The electrical energy is then stored in the capacitor. The left circuit shown in the picture for the Circuit of Green Light acts as an electronic switch to activate the relay. During day time, the amount of sunlight falling on the light dependent resistor (LDR) is high. As such, the resistance to the LDR is low. Therefore the current flows from the electrical source to the ground. The transistor is thus not turned on and the relay is in the Normally Closed position.

During the night time, the amount of sunlight falling on the LDR is low, as such the resistance of the LDR is high, and the amount of current flow through the transistor is higher and turns on the transistor. The relay is thus activated and in the Normally Open position. The capacitor that has been charged in the daytime will thus discharge and light up the green light. This is simulated in the video when the LDR is blocked by a piece of an opaque object.

Warning:

- *Video / animated simulation only if prototyping is absolutely no possible.*
- *Video / animated simulation must be logical and convincing that the invention works.*
- *Constraints must be clearly included in the logbook or the project will be heavily penalized.*

5. References

Read <http://www.bibme.org/citation-guide/apa/> on how to cite references.

6A Cite the references you have used for your project work. Your source of reference should come from different types (eg books, magazine, websites, journal articles, interview, photographs, product brochure, reviews, etc.)

Research on the destruction of natural habitats and fishing grounds by overfishing(2017)Retrieved August 5 from:

<https://sciencing.com/destruction-marine-ecosystem-5777.html>

Destructive fishing methods used that harm the environment:

https://wwf.panda.org/our_work/our_focus/oceans_practice/problems/destructive_fishing/

Picture of poor fisherman houses (2007)Retrieved 5 August 2020 from:

<https://www.ifrc.org/en/noticias/noticias/asia-pacific/thailand/water-is-life-for-poor-fishing-villages-in-southern-thailand/>

Picture of green light attracting fishes

<https://360digitour.com/fishing/best-underwater-fishing-lights/>

Solution for poor fishing villages

https://www.foodforthepeople.org/newsroom/archive_14/first-fishing-villages-in-honduras.html

The picture on how piezoelectricity works

<https://www.electronicdesign.com/power-management/article/21801833/what-is-the-piezoelectric-effect>

<https://rethink.earth/redefining-poverty-in-kenyas-fishing-villages/>

https://www.nature.com/scitable/blog/saltwater-science/what_makes_plankton_migrate/

Case study of poverty in fishing villages

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1066.4457&rep=rep1&type=pdf>

