Borneo Engineering & Advanced Multidisciplinary International Journal (BEAM)
Volume 2, Issue 2, November 2023, Pages 15-18

Research of Innovation Smart Sensor Floating Trash Trap

Juhaidie Zamani Jamaludin[1]*

[1]Department of Civil Engineering, Politeknik Mukah, KM 7.5 Jalan Oya, 96400 Mukah, Sarawak, Malaysia

*Corresponding author: juhaidiez@pmu.edu.my
Please provide an **official organisation email** of the corresponding author

Full Paper

Article history
Received
1 August 2023
Received in revised form
23 October 2023
Accepted
24 October 2023
Published online
1 November 2023

Abstract

The collection and disposal of rubbish in modern cities causes environmental issues. As a result, cities that want to manage costs, resources, and time efficiently must now implement smart waste management systems. To solve everyday difficulties like trash management, the trend is now moving toward smart gadgets and internet of things (IoT) solutions. Optimizing the process of trash collection is the main purpose of the smart solutions provided by industry. However, the cost of applying such solutions is still relatively high. The purpose of this research is to present an effective smart sensor floating trash trap for localized and small-scale cases, such as small parks, university campuses, and housing areas. The literature of this research will present a literature review of past related papers and commercial solutions. The methodological section describes the process of producing products. The data obtained was analyzed to obtain results at the site, in addition to the design of the floating garbage trap and smart sensors. Finally, the results of this conclusion also show that the product can solve the problem of waste on a small scale resulting from discharge in the drain. and future work.

Keywords: - Waste, recycled, trash traps, waste characterization

1. Introduction

The problem of uncontrolled waste disposal everywhere including waterways, rivers, and oceans, is not new. Pollutants are made up of materials such as plastics, metal, paper, cans etc. (Ab Ghani, et al., 2011). Pollutant problems are caused by the industrialization and the urbanization of the world. The amount of plastic production is getting higher as it increases from 1.7 to 288 million tons for the past 60 years (Gasperi et al., 2014). Even so, consciousness in society will be important. Several innovations have been developed to help with the management of waste.

Based on Glascock (2016), annually there are about 8 million tons of plastic that escape to the ocean, and it is predicted that there will be 1 ton of floating debris for every 3 tons of fish in the sea.

Waste is defined by how much, for example, dried leaves, twigs, plastic, aluminum cans and many others. To reduce this waste, it should be planned so that it can be reduced. (B.A.E. Gay et al, 1994). Characterization of municipal to county solid wastes and forecast waste-generation rates are essential to planning and implementing disposal and recycling activities (M.B.L.D. Diola et al., 2020).

In the case studies that have been carried out, which focus on drainage drain water and garbage that is often seen besides leaves and twigs of trees, domestic garbage is also a factor in clogged drains, such as plastic bottles, food wrappers, beverage cans, and waste materials that are hard to rot. These garbs can not only invite the stench, place mosquito breeding, and even be the focus of mice and flies that can invite various kinds of dangerous diseases and disrupt the surrounding ecosystem. Even the safety of the locals can also be disturbed.

This research aims to design, fabricate, and test the floating trash traps using recycled material and characterize the collected waste in selected perimeter drain at Politeknik Mukah quarters area. These model traps are strategically placed in perimeter drain to stop

solid waste. Specifically, the study will: design a floater trash trap using recycled material.

Objectives of this research is to design products that can collect garbage in drain holes, develop products to reduce the effects of pollution and testing the effectiveness and functionality of the product in terms of reducing the cost of maintaining clogged drains.

The scope of this project is applicable to the drain hole measuring 26 cm x 31 cm x 26 cm. In terms of that, this research focused on drains in staff residences at Polytechnic Mukah Sarawak, concentrated on the drain flow and directly to the main drain. It is easy to develop as it is made from environmentally friendly materials, and by using sensors on this product, it provides a value-added element of Industrial Revolution 4.0 (IR4.0).

2. Methodology

This study was carried out by producing a model of the product to be designed, collecting information, and analyzing the data obtained throughout the study, as shown in Fig. 1.

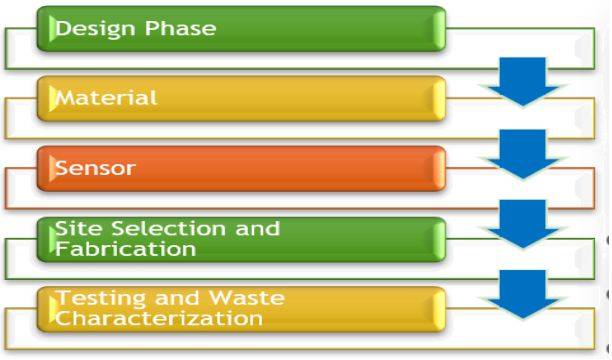

Fig. 1. Methodology flowchart

2.1 Design Phase

The design of the drain floater trash traps is the first step in the process. To ensure that the project performs successfully in both predicted and worst-case circumstances, the necessary functions of trash traps are identified in this phase while taking the design parameter and engineering concept into consideration. The traps are made with the following characteristics of the materials:

a) Floating Material

It acts as a barrier for the garbage that is gathered by floating; Tying material is used to bind and retain the floating material together; The floating material is covered with a net, which also serves as a mesh for solid trash that escapes the trap. Rope: This is used as the tension cable from the post connecting the trash traps on either side of the river.

The choice of material is carried out based on count, suitability and low cost. The materials used are easily obtained and meet the objectives of the study. The design of the drawing is made to depict the model to be produced.

2.2 Site Selection and Fabrication

The next study strategy is to locate rivers and potential site locations. However, based on the purpose of putting traps, researchers developed and applied deciding elements to pick drain and potential places. Additionally, preliminary research and measurements on drains have been made for usage in the creation phase of trash traps.Engineering methods appropriate for each part and component of trash traps were used in the fabrication process.

2.3 Testing and Waste Characterization

For testing and data collection on waste characterization, phase traps were put together and installed in a few different bodies of water. This floater is monitored by researchers to ensure it is safe and in good condition. To separate the waste, it is physically removed from the traps and placed in a trash bag. This procedure, which is repeated every seven days for a month, classifies the samples into biodegradable, recyclable, residual, and special trash. The wet weights of the samples for each category and type were recorded by the researchers. Calculating the waste produced by each trap and compiling a list of potential causes for design improvement served to finalize the outcome. As a last step, the researcher properly disposed of garbage.

3. Result and Discussion

The installation was done according to the prescribed steps. All points are considered so that the data obtained can be accurately evaluated. in the fabrication of traps. All details were secured and surely firmed to avoid such problems during data gathering shown in Fig. 2.

Fig. 2. Floating trash trap

The data obtained is collected and weighed to gain its weight. It is determined by class. for 1 month depending on the rainy day shown in Fig. 3 to Fig. 6.

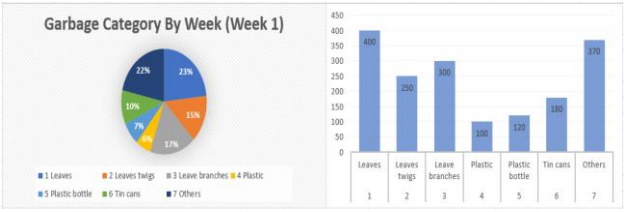

Fig. 3. Garbage category week 1

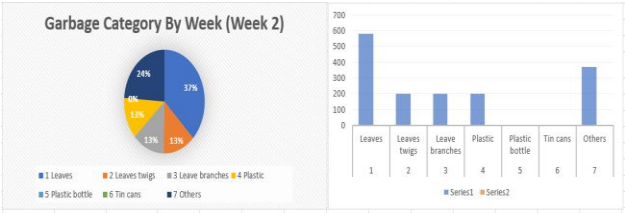

Fig. 4. Garbage category week 2

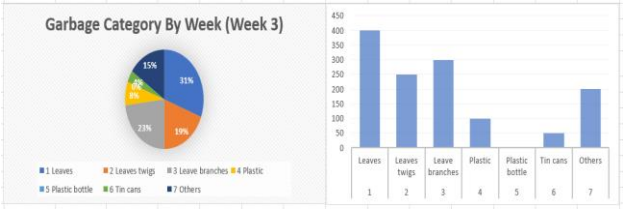

Fig. 5. Garbage category week 3

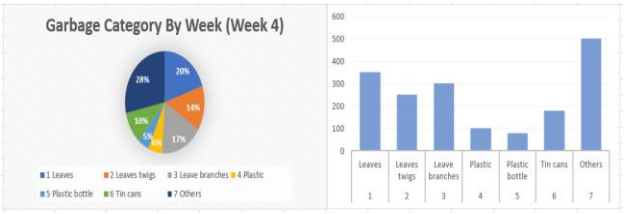

Fig. 6. Garbage category week 4

On-site monitoring is carried out weekly. All data was taken for analysis in a waste trap. From the data collection, the traps generated a total of 6,830 grams, leaves 24%, leave twigs 14%, leave branches 16%, plastic 7%, plastic bottle 4%, tin cans 8% and others 27% shown in Fig. 7.

No	Item	Total	Percentage (%)
1	Leaves	1630	24%
2	Leaves twigs	950	14%
3	Leave branches	1100	16%
4	Plastic	500	7%
5	Plastic bottle	240	4%
6	Tin cans	540	8%
7	Others	1870	27%
	Total	6830	100%

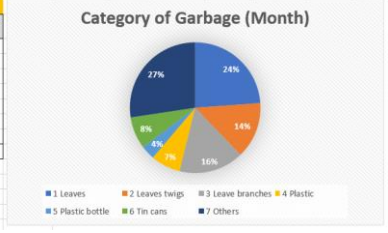

Fig. 7. Category of garbage (month)

4. Conclusion

This floating trash trap has shown a high level of effectiveness in trapping waste where almost all the garbage that goes into the drainage is stuck in a garbage trap. From the tests done, all the rubbish that has been declared is retained in high percentage. This shows an effective structure in trapping all kinds of garbage.

Some suggestions to enhance the effectiveness of this waste trap are:

i. Perform site experiments in contaminated drains. This is important for covering the level of water quality after the installation of a garbage trap.
ii. Produce a more practical waste trap model for use on large drain parameters.
iii. Increase data intake when raining to know the reliability and effectiveness of the structure.
iv. Determine water quality parameters to assess its effectiveness in improving water quality levels in drains.

As a result of this Research of Innovation Smart Sensor Floating Trash Trap project, it can be concluded that Research of Innovation Smart Sensor Floating Trash Trap has achieved the objective of the study which is to build a waste collection machine that can save time and even ergonomics, test the effectiveness of the product to collect waste according to the amount of collection and test the ability of this product to collect waste in the drain area of the parameters in the building.

The idea of the smart sensor floating trash trap has proven that it has the potential to accumulate waste from the perimeter drain at the building. The traps generated leaves, leave twigs, leaves branches, plastic, plastic bottle, tin cans, and others.

The results of this study can be used by various sectors including government and private sector in safeguarding the environment.

Acknowledgement

This research is fully supported by the Management of Politeknik Mukah Sarawak and Department of Civil Engineering, Politeknik Mukah Sarawak which makes this important research viable and effective.

References

Ab Ghani, A., Azamathulla, H. M., Lau, T. L., Ravikanth, C. H., Zakaria, N. A., Leow, C. S., & Yusof, M. A. M. (2011). Flow pattern and hydraulic performance of the REDAC Gross Pollutant Trap. *Flow Measurement and Instrumentation*, *22*(3), 215-224.

Gasperi, J., Dris, R., Bonin, T., Rocher, V., & Tassin, B. (2014). Assessment of floating plastic debris in surface water along the Seine River. *Environmental pollution*, *195*, 163-166.

Glascock, T. (2016). The Problem of Ocean Trash. Ocean Conservancy. Retrieved November 14, 2022 from

https://oceanconservancy.org/blog/2016/08/22/the-problem-of-ocean-trash/.

Gay, A. E., Beam, T. G., & Mar, B. W. (1993). Cost-effective solid-waste characterization methodology. *Journal of environmental engineering*, *119*(4), 631-644.

Diola, M. B. L. D., Tanchuling, M. A. N., Bonifacio, D. R. G., & Delos Santos, M. J. N. (2020, May). Characterization of plastic pollution in rivers: case of Sapang Baho River, Rizal, Philippines. In *EGU General Assembly Conference Abstracts* (p. 22467).

Marine Debris Program. (n.d.). What is Marine Debris?. Retrieved May 22, 2022 from https://marinedebris.noaa.gov/discover-marine-debris/what-marine-debris.

IUCN. (2021). Marine plastic pollution. *Internal Union for Conservation of Nature*. Retrieved May 22, 2022 from https://www.iucn.org/resources/issues-brief/marine-plastic-pollution.

Barboza, L. G. A., Cózar, A., Gimenez, B. C., Barros, T. L., Kershaw, P. J., & Guilhermino, L. (2019). Macroplastics pollution in the marine environment. In *World seas: An environmental evaluation* (pp. 305-328). Academic Press.

Ritchie, H. (2021). Where does the plastic in our oceans come from?. *OurWorldInData.org*. Retrieved May 22, 2022 from https://ourworldindata.org/ocean-plastics.

Gokkon, B. (2019, June). Southeast Asian countries pledge to tackle marine plastic waste crisis. *Mongabay Series: Oceans, Sea Change*. Retrieved May 22, 2022 from https://news.mongabay.com/2019/06/southeast-asian-countries-pledge-to-tackle-marine-plastic-waste-crisis/.

Van Ryan Kristopher, R. G., Jaraula, C. M. B., & Paler, M. K. O. (2021). The nexus of macroplastic and microplastic research and plastic regulation policies in the Philippines marine coastal environments. *Marine Pollution Bulletin*, *167*, 112343.

Mulya, K. S., Zhou, J., Phuang, Z. X., Laner, D., & Woon, K. S. (2022). A systematic review of life cycle assessment of solid waste management: methodological trends and prospects. *Science of The Total Environment*, *831*, 154903.

SCIENCING. (2018, December). What Are Different Ways That People Waste Water?. Retrieved May 22, 2022 from https://sciencing.com/what-are-different-ways-that-people-waste-water-4857111.html.

Anjana, K., Hinduja, M., Sujitha, K., & Dharani, G. (2020). Review on plastic wastes in marine environment–Biodegradation and biotechnological solutions. *Marine Pollution Bulletin*, *150*, 110733.

Silva, J., Morse, M., & Tamayo-Cañadas, V. (2021). Plastic waste capture in rivers An inventory of current technologies. *Benioff Ocean Initiat*. 1–50.

Datu, C. L. J. (2020, August). DENR trash traps to reduce solid waste in Manila Bay. *SunStar Pampanga*, 1-11.

CalRecycle. (n.d.). What is Waste Characterization?. Retrieved May 23, 2022 from https://www2.calrecycle.ca.gov/WasteCharacterization/General.