OIL TRAP[1]

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Abstract: This project we've developed is not-so-talked-about but really important environmental issue: how household cooking oils are usually just poured down the sink and how that's bad for the environment. Usually, people don't think much of it when they dump used cooking oil down their kitchen sinks, but when everyone does it, it adds up and becomes a big pollution problem. What our project does is, it separates this waste oil from the water before it can cause any harm. We've come up with some filtering methods to do this. The main trick behind our system is using the fact that water and oil don't mix because they have different densities. This means we can separate the oil from the water. While this kind of system is something you'd usually find in big industries, it's not something people have in their homes yet. So, we're trying to change that and make this system something you can use at home as well. This isn't just about making a new gadget for the house. It's really about doing our bit for the planet. Stopping these oils from getting into our water systems is a big deal for the environment. Plus, by bringing this technology into homes, we're hoping to change how people think about and deal with their kitchen waste. It's all about making a cleaner, greener future and showing that even the small things we do at home can make a big difference.

Keywords: Household Cooking Oils, Sink Disposal, Oil and Water Separation, Density Difference, Filtering, Environment

INTRODUCTION

This study was produced from the "Course Project" of the first and third authors, of Maltepe University Faculty of Engineering and Natural Sciences, where the second author is an advisor teacher. ORCID ID: 0009-0001-4696-4134.

RELATED WORKS

In the study [1] published at April 21, 2022 JOTCS (Journal Of The Turkish Chemical Society) is similar to our project. but has progressed in a different business line. They use membrane filtration separate to dirty oil from water like we did.

study [2] published at October 2022 Düzce University Science and Technology Journal Oil-grease separation was used as we did in our project as seen in this article. Separation; The collected wastewater is separated with water due to the density of oil and grease in it. Oil and grease rise to the surface of the water and are separated at this stage. Collection and Disposal; The oil and grease that rise to the surface are collected in a special unit or chamber. The oil and grease from this unit is then disposed of appropriately. In some cases, these oils can be recycled and contribute to energy production. This method was also used in our project.

The study [3] published at Mohr Separations Research, In this study, the decomposition method is used as a method that we use in our project. Coalescing plate module type oil-water separators are defined as a solution that separates oil from water using only the force of gravity. These module type separators are generally permanent and maintenance-free. Additionally, there is no need for consumables or absorbents such as filter cartridges.

PURPOSE

The oil trap operating principle turns the density difference of water and oil into an advantage and separates oil and water from each other by keeping the water at the bottom. First, the filtering stage is started. The first filter is used to separate large particles in dirty water. In the second filtering, the waste oil is kept at the top and the water is passed through the bottom part, making the water cleaner. In the next step, the water is filtered by keeping the small amount of remaining oil at the top and is ready to be sent to the sewer.

In the research we conducted in this project, which we designed to prevent increasing water pollution, it is known that 1 liter of waste oil pollutes 1 million cubic meters of drinking water. We wanted to develop a low-cost but useful design to reduce this problem and leave a cleaner world to future generations.

SCOPE

Our project was specifically designed to reduce environmental pollution caused by improper disposal of cooking oils at home. Typically, these oils are poured into sinks, causing significant water pollution. The essence of our system is an innovative approach

that takes advantage of the natural density difference between water and oil. By doing this, it efficiently separates waste cooking oil from water. This separation process is not only crucial to preventing oils from entering our waterways, but also plays an important role in reducing the load on wastewater treatment plants. In the first stage of filtration, our system aims to remove large particles from the water, making the subsequent stages more effective. Following this, a second, more refined filtering process takes place. Here, the waste oil is isolated at the top since its density is lighter, allowing the cleaner water at the bottom to pass through. This progressive filtration not only increases the purity of the water, but also facilitates the collection of waste oil, which can then be disposed of responsibly or repurposed.

METHOD

Uno Arduino: Water pumps are controlled using Uno Arduino. With the first water pump, water is sent into the oil trap. The second water pump ensures the flow of water in the oil trap.

Filtering System: There are 3 filters in the oil trap: the head part, the middle part and the last part. The filter in the head separates the solid particles in the dirty water and allows the remaining dirty water to pass to the middle part. There is a filter in the middle part that will retain the oil at the upper level of the dirty water by using the density difference of oil and water. In the last part, the filtering method used in the beginning is used again and the dirty water is filtered one last time and transferred to the sewer.

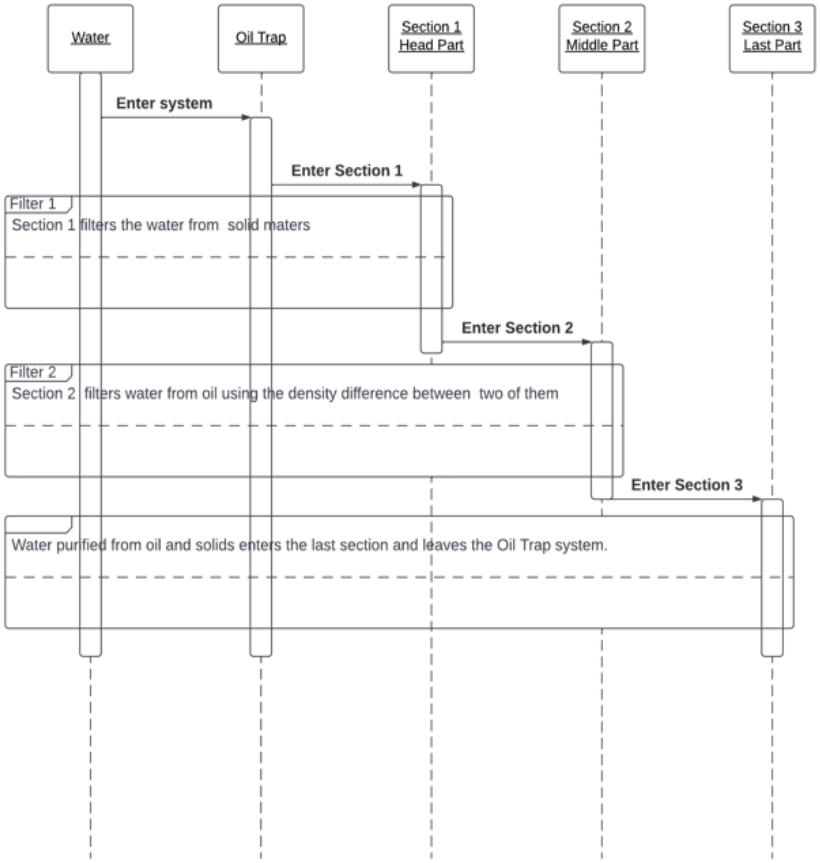

Fig. 1. The Sequence Diagram of Project

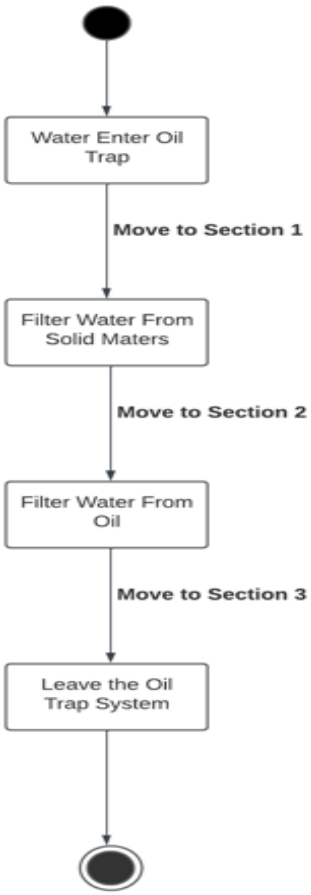

Fig. 2. The UML Activity of Project

KEY FINDINGS

Water: The density of pure water at room temperature (around 20°C or 68°F) is approximately 1 gram per cubic centimeter (1 g/cm^3) or 1,000 kilograms per cubic meter (1,000 kg/m^3).

Oil: The density of cooking oils varies slightly depending on the type, but it is typically less than that of water. Most cooking oils have densities around 0.92 g/cm^3 to 0.93 g/cm^3. This means they are lighter than water and will float on top of water.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

For 1 liter water (1000 cm^3) and 1 liter oil(1000 cm^3):

- Mass of water = Density × Volume = 1.0 g/cm³ × 1000 cm³ = 1000 grams.
- Mass of oil = Density × Volume = 0.92 g/cm³ × 1000 cm³ = 920 grams.

CONCLUSION

As a result of this study; It has been observed that the oil trap system operates smoothly. Filtering processes work smoothly thanks to the density difference. Although several different scenarios were considered, it was ultimately decided to use this system.

In the following versions of this study, we will focus on how it can be made more useful in all households. We aim for the filtering system to work more automatically.

PICTURES OF SYSTEM

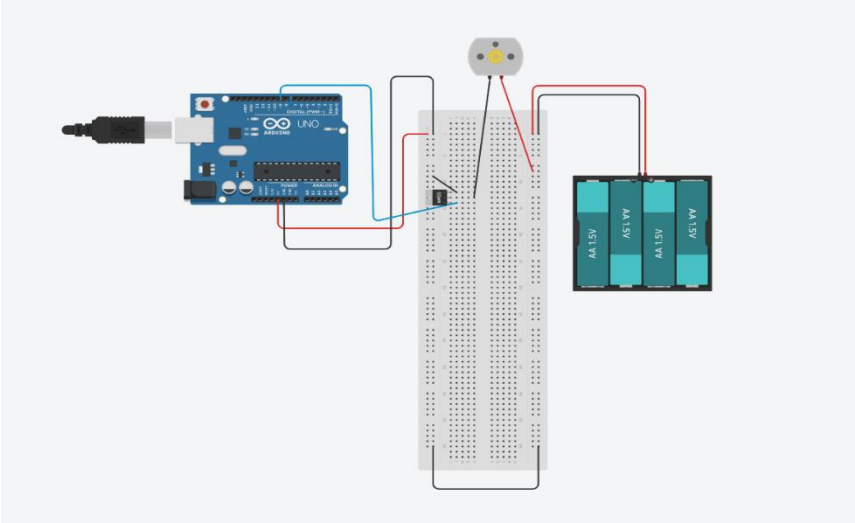

Fig. 3. Arduino water pump circuit

Thanks to the water pump, we ensure the flow of waste water in the system.

Fig. 4. Servo motor Arduino circuit

We use the servo motor to control the inlet and outlet of wastewater. Thanks to the button, we can control when water will be entered into the system.

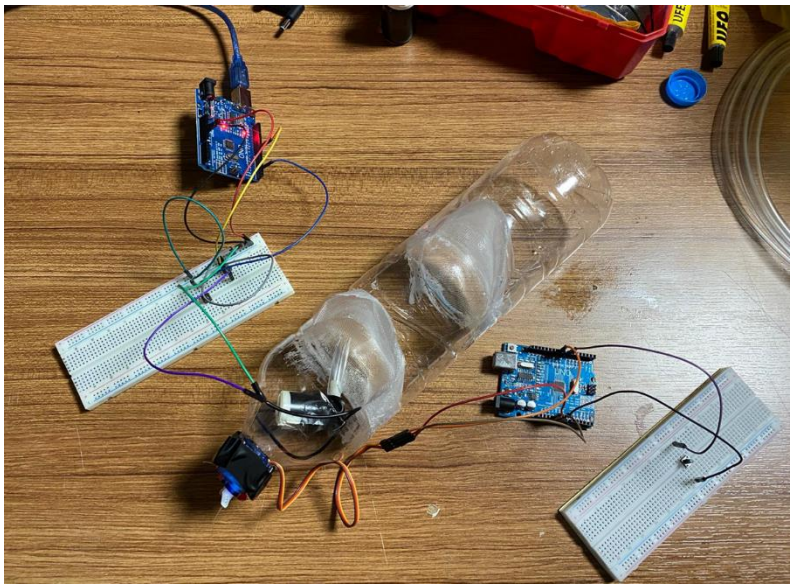

Fig 5. Final system

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