1. PROBLEM STATEMENT

The Jelly-Bot is a robotic tool designed to address a major contributor to freshwater pollution. This automated robot is aimed at helping maintain Earth's waterways. The following sections explore the benefits, design, and background of this device.

1.1. Need Statement

According to Ocean Conservancy, plastic pollution inputs into rivers, lakes, and the ocean could increase to as much as 53 million metric tons annually by 2030, even if current reduction commitments are met [1]. The World Wildlife Fund stated that between 24 to 35 million metric tons of plastics entered aquatic ecosystems (both freshwater and marine) in 2020 alone [2]. Unlike other pollutants in water, plastic does not decompose and therefore has a lasting impact on not only freshwater organisms but also the larger environment. The Environmental Protection Agency's Freshwater and Marine Regulatory Branch has a program to prevent or limit the dumping of any material that would adversely affect human health and aquatic environments, while the state governments are expected to manage their water pollution with varied success [3]. A high impact unmanned aquatic robot dedicated to picking up trash is needed.

1.2. Objective Statement

The Jelly-Bot, an aquatic robot aimed at mitigating water pollution by collecting waste from ponds or rivers, is technologically designed to address pollution in aquatic environments. Design objectives are centered around creating a semi-autonomous and efficient system capable of navigating diverse aquatic environments while collecting and managing waste. The technical solution involves a precise navigation system enabling coverage over large areas, environmental monitoring sensors to identify and locate pollutants, and a versatile assembly mechanism to gather debris of assorted sizes without causing harm to aquatic ecosystems.

1.3. Background and Related Work

Although many are educated about the dangers of water pollution, the conversation often centers on preserving the oceans rather than smaller, local bodies of water. It is essential to note that freshwater is equally vulnerable to pollution, with a significant portion of contaminants resulting from human action. Metals, plastics, pesticides, and other chemicals can disrupt underwater ecosystems, leading to pollution on both a local and global scale. Our World Data states that approximately 1.4 million tons of plastic are carried into the ocean via rivers [5]. Human activity's plastic contribution to pollution is dire not only because plastic does not decompose, but also leads to the death of ecosystems, causing more waste to be evident. Freshwater ecosystems affect humans tenfold due to the need for freshwater in many countries, states, and cities as close to home as Jackson, Mississippi. Like pollution, aquatic robots are not a new concept. Aquatic robots are becoming increasingly popular in research, conservation, and underwater exploration [6]. However, there are very few aquatic robots designed to combat underwater waste. Options such as the WasteShark, only clear pollutants off the water's surface, while others such as the BeachBot are not designed for water, and detect one type of pollutant, cigarette butts [7],[8]. The Jelly-Bot is committed to efficiently collecting plastic and other pollutants from freshwater environments, with the goal of minimizing freshwater pollution by preventing these pollutants from reaching the ocean.

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