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A REVIEW ON SOLAR POWERED LAKE CLEANING ROBOT

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Abstract: ***Natural lakes and all kinds of artificial lakes make the living environment beautiful. However, with the increase of the activities of human beings, the pollution of the floating garbage on the surface of the lake is serious. Governing the pollution of the floating garbage on the surface of the lake is urgent. Water pollution with floating garbage is a serious issue in many countries. The process of cleaning the water surface is a routine task. Collecting large amounts of dry waste floating such as plastic bottles confront the tension on the water surface and small drag force causes the waste materials to float away. The aim of this project is to design a robot that will assist humans with collecting waste materials by scooping the waste off the water surface and promote the use of clean energy technologies for environmental conservation.***

Keywords: Water pollution, floating debris, purification, solar powered.

I.INTRODUCTION

In developing countries, growing amounts of dry waste in canals, ponds, and lakes affect water drainage and life quality of residents living close to those areas. Often found floating waste is such as plastic scraps, foams, tree leaves, and aluminum bottles. Accumulation of the dry waste floating on the water surface can obstruct water drainage in city canals and cause floods. Water surface cleaning must therefore be done regularly. Due to less specific weight than water, the dry waste such as foams or plastic bottles can be easily observable on water surface. As the waste has a small drag force and water surface tension causes surface waves, the waste usually flows away when reaching by ship or boat. The typical waste collected by humans is often done by using a scoop net with a long handle. However, the operation requires much effort from the cleaning team when the amount of waste is enormous. In this work, we focus on collecting the waste floating on the water surface automatically and segregate the waste into bio degradable and non-bio degradable and dump them in separate bins.

II.LITERATURE SURVEY

The introduction of a water body cleaning robot controlled through a website using IoT technology is done that aims to prevent direct human contact with water bodies to avoid infections from microbes. Solar energy is employed to minimize power consumption. The robot's coverage and waste collection depend on user input. The design incorporates solar charge control, an IR sensor for object detection, and a user-accessible website via QR code scanning. Users install an application through the QR code, granting them control over the robot's functions. Waste is stored at the water body's bank, and users can operate the robot from there.[1]

A semi-automatic drain for sewage water treatment of floating materials is used as an innovative solution to replace manual labor in drainage cleaning. This highlights the crucial role of mechanical drainage systems in industrial applications for proper sewage disposal. Despite the significance of these systems, the manual cleaning of blockages poses challenges and even risks human lives. In response to this issue, the authors propose a design for a mechanical semi-automatic drainage water cleaner. The goal is to efficiently manage waste disposal, prevent blockages, and ensure regular filtration of wastages, ultimately enhancing safety and reducing reliance on manual labor in drainage maintenance.[2]

A river cleaning robot is designed to remove waste debris from the water floor and deposit it in a tray. The device utilizes fins connected to a rod outside the boat, and the flow of water from these fins collects floating solid waste. To enhance garbage collection efficiency, the authors propose using an advanced conveyor system and conveyor material. Additionally, instead of relying on battery operation, the robot is powered by a solar panel, aiming to increase sustainability and reduce environmental impact.[3]

SMURF introduces a novel autonomous water surface waste cleaning robot. This robot is designed to achieve high-efficiency cleaning without requiring human operation. o initiate cleaning in a new water body, a one-time initialization process is required. During this phase, a cleaning boundary is manually set on a satellite map using an application on a mobile phone, PAD, or PC. A home point is also established to complete the initialization. Once initialized, SMURF autonomously executes its cleaning procedure. It follows a pre-planned coverage path, covering multiple cleaning areas if necessary. After completing the cleaning task, SMURF autonomously returns to the home point, indicating the completion of the cleaning cycle. The robot then awaits trash disposal and charging.[4]

The system is a stationary autonomous surface vehicle equipped with a surface waste collection unit and sensors to monitor both waste and system performance. To direct floating waste to the system, a barrier setup is employed. The flight conveyor is activated to pick up floating waste, loading it onto a distributed conveyor belt. Ultrasonic sensors measure the waste level in all dust bins, and when the distributed conveyor is full, the waste is evenly distributed into the bins. Simultaneously, pH and water level in the river are monitored using sensors. The system incorporates real-time monitoring, with sensor data published on a website for external viewing.[5]

Raspberry Pi, the main computing board, manages image processing, object classification, and motion controls, while Arduino is connected to the LoRa module and a water testing unit. The robot employs object classification to segregate ocean pollutants and collect them in a specific compartment for easier recycling. It features a LoRa-based communication system for device-to-device communication and with gateways at the base station. Water testing sensors like pH and conductivity sensors monitor water quality. The robot is fully autonomous, utilizing an on-board GPS module for location tracking. The collected water quality data and pollutant information from the machine learning model can contribute to formulating local laws to reduce pollution and raising awareness about the types of materials ending up in oceans or water bodies.[6]

The system is described as a floating waste collector machine in the form of a boat that moves to different areas of a water body, cleaning light and floating wastes. The process involves setting up Bluetooth connectivity between an Android application and a Bluetooth module. After ensuring the connection, predefined instructions are sent to the microcontroller of the mobile handset. These instructions are stored on a specified Android application installed on a mobile device. The application allows the user to provide navigation commands to the Arduino program. Once connected, the boat can be navigated using motor drive for forward and backward movements. Additionally, a conveyor belt connected to a motor is activated to collect water waste from the water surface.[7]

The machine is designed to remove waste debris from the water surface and safely dispose of it from the water body. The motivation behind the project stems from the current condition of national rivers, which are filled with sewage, pollutants, toxic materials, and debris, posing a threat to aquatic life. The machine aims to lift surface debris, reducing water pollution and minimizing the risk to aquatic animals. The project's primary goal is to decrease the need for manual labor and reduce the time required for river cleaning. Energy is stored in a battery, which is then utilized to power a motor and chain drive arrangement for effective river cleaning.[8]

The primary objective is lifting off waste debris from the water surface and disposing of it in a tray. The machine features a conveyor arrangement on a motor shaft, collecting water debris, waste garbage, and plastics from water bodies. Utilizing a four-bar mechanism, the machine rotates at a specific angle to gather rubbish. It has two windows that can be opened and closed using a remote control to turn the mechanism on and off. A water wheel, bolted on a shaft, moves the machine forward or backward on water. A motor, through a chain drive mechanism, rotates the water wheel. The project includes a tracking system to control the angle of the solar array with respect to sunrays, optimizing solar output.[9]

The machine utilizes a chain drive mechanism to lift pans with the help of chains aligned with sprockets. The drain cleaner is designed to clean both small and large sewage through its mechanical structure and operation. When power is supplied to the machine, the motor starts functioning, causing the shaft and connected sprockets to rotate. This rotation drives the chain connected to the sprocket, leading to the rotation of two lifters attached to the chain at half its length. Positioned across the drain, the device allows only water to flow through the lower grids, while waste materials such as bottles floating in the drain are lifted by the teeth of the lifters connected to the circulating

chain. The waste materials are then stored in a waste storage tank for disposal.[10]

The machine intends to lift waste debris from the water surface and dispose of it in a tray. The entire device is controlled remotely using an RF transmitter and receiver. The RF module includes an RF transmitter and an RF receiver operating at a frequency of 434 MHz, allowing for wireless control of the machine through serial data transmission. The machine is remotely operated and features a continuous rotation of collecting plates and chain drives driven by a motor. The collecting plate, placed between two chain drives, collects waste materials from the river. A conveyor helps throw the collected wastages onto the collecting tray. The machine is propelled on the river by a propeller powered by two PMDC motors.[11]

An innovative approach to enhancing the cleanliness of waterways, this system employs a GPS-guided river cleaning robot equipped with sensors and cameras to navigate waterways and autonomously clean up debris. The robot is initially programmed with a pre-set course using GPS coordinates, and once in the water, it follows this course while scanning for debris. As the robot moves through the water, its sensors and cameras detect and identify debris, which is then collected using an onboard system, typically a conveyor belt that moves debris into a storage compartment. This storage compartment can hold a substantial amount of trash and can be emptied and replaced as needed and the robot is powered by an electric motor.[12]

The use of a battery-operated boat equipped with a belt conveyor to collect garbage from both small and large water bodies. A buzzer is incorporated to add sound features to the project. The Lake Cleaning System robot is propelled in water by DC motors connected to the ESP32. It comprises two DC motors, a relay, ultrasonic sensor, gripper, IR sensor, trash can, and a transistor. The relay facilitates the movement of the robot by controlling the motors. The speed of the motors is set for effective movement. An ultrasonic sensor connected to the ESP32 detects objects as the robot moves on the water surface. A gripper is mounted on the front side of the robot with proper ground clearance, collecting rubbish and pushing it into a bin located behind the mechanism. The robot continues to gather garbage until a specific height of the bin is reached. This IoT-enabled river cleaning robot provides an efficient and automated solution for cleaning water bodies.[13]

The utilization of sensors to record various parameters, including obstacle detection and their distance from the boat, as well as identification of living or non-living organisms. The system design is divided into two stages: the first stage involves the assembly of the water boat with sensors, and the second stage focuses on the robotic arm. The system employs two Arduino Uno boards: one controls the wheels of the boat and processes sensor inputs, while the other is responsible for controlling the robotic arm. The hardware requirements are discussed in detail. The simulation is conducted in two phases: the first phase involves an Infrared (IR) controlled DC motors assembly with sensors to demonstrate the working of the water boat, and the second phase showcases Arduino-controlled servo motors using push-button switches, illustrating the functionality of the robotic arm. Overall, Swachh Hasth is designed to efficiently address water cleaning through a combination of sensor technology and a robotic arm.[14]

The robot aims to remove waste particles from the water floor and collect them in a plate and is designed as a Bluetooth-operated waterway cleaning device. The collection arm is manually operated by an engine through Bluetooth control. The collection plate is positioned between two hollow PVC channels to gather waste materials from the waterway. The entire electrical system is controlled by Bluetooth and a joystick for remote operation. The remote includes switches to control the L23D9 motor, with adjustments made through Bluetooth. This design offers an automated and remotely controlled solution for cleaning rivers, contributing to effective waste removal from water bodies.[15]

III.GAP ANALYSIS

In the above papers, some of the systems are not solar powered, hence requires lot of non-renewable energy to drive the device. Some systems are fully remote controlled and does not turn ON automatically. It always calls for a person to be available and some do not contain ultrasonic sensors. This will not be ideal for use if there are any large materials in the water body. The use of GPS technology completely makes the systems inefficient when the water keeps moving. In all the above systems, the waste on the water surface is just collected but not segregated into bio-degradable and non-bio-degradable wastes.

IV.PROPOSED SYSTEM

The proposed system is a solar powered robot that is used for scooping off the waste or floating debris on water bodies. This system will automatically move in the water and can also be remote controlled when the waves are strong. It will collect the waste and segregate them into bio-degradable and non- bio degradable waste and dump them in separate bins.

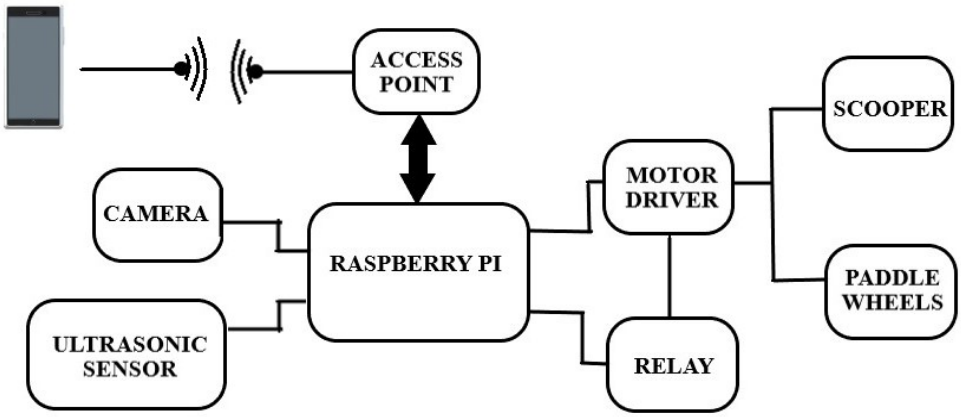

FIG.1. Block Diagram

V.APPLICATIONS

- Floating debris collection
- Reduction of water pollution.
- Remote monitoring and controll.

VI.CONCLUSION

A solar powered lake cleaning robot is a effective solution for maintaining the cleanliness and health of lakes. By harnessing the power of sun, these robots can operate efficiently and sustainably. Implementing these robots can contribute to the preservation of ecosystem, improve the water quality and promote a healthier environment for both aquatic life and humans.

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