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Automated Oil Skimmer Boat

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Abstract: Oil spills in oceans, rivers, and industrial water bodies are a major environmental problem that threatens marine ecosystems and aquatic life. Conventional oil spill cleanup techniques such as manual skimming, absorbent materials, and chemical dispersants are inefficient, labor-intensive, and often harmful to the environment. This project proposes the design and development of an Automated Oil Skimmer Boat, capable of collecting floating oil from the water surface using a mechanical skimming mechanism. The system integrates a floating hull structure, a conveyor-belt or disk-type skimmer mechanism, propulsion motors, and a microcontroller-based control system for navigation and automation. The collected oil is separated and stored in an onboard tank for safe disposal. The boat can operate either autonomously or through remote control, reducing human intervention and increasing efficiency. The proposed system offers a cost-effective, environmentally friendly, and scalable solution for oil spill remediation in marine ecosystems, rivers, harbors, and industrial wastewater environments.

Index Terms - Oil Skimmer, Oil Spill Cleanup, Autonomous Boat, Environmental Robotics, Water Pollution Control

I. INTRODUCTION

Oil pollution in oceans and water bodies has become a serious environmental issue due to accidents involving oil tankers, industrial discharge, and offshore drilling activities. These incidents cause significant damage to marine ecosystems, aquatic organisms, and coastal environments.

Traditional oil removal techniques include manual skimming, absorbent materials, floating barriers, and chemical dispersants. Although these methods are widely used, they are often inefficient, time-consuming, and hazardous to both humans and the environment.

To overcome these challenges, automation and robotic systems can provide more efficient and safer solutions. The **Automated Oil Skimmer Boat** is designed to collect floating oil from water surfaces using a mechanical skimming mechanism integrated with control systems. The boat navigates across contaminated areas, collects oil using an oleophilic belt, and stores it in a collection tank.

This system reduces manual labor, improves oil recovery efficiency, and helps protect aquatic ecosystems from pollution.

THE OBJECTIVE OF THIS PROJECT IS TO DEVELOP A HUMANOID ROBOT CAPABLE OF:

- Collecting floating oil using a mechanical skimming mechanism
- Separating oil from water efficiently
- Storing the collected oil in an onboard container
- Navigating across the water surface using a motor-driven propulsion system
- Reducing manual effort and human exposure to polluted water
- Improving efficiency of oil spill cleanup in rivers, lakes, and oceans
- Providing an eco-friendly and cost-effective solution for water pollution control

This project is divided into two major development phases:

- Phase 1 – Designing of Electrical Circuit
- Phase 2 – Completion of Project

II. LITERATURE REVIEW

Several studies have explored different oil spill cleanup techniques and skimming mechanisms.

Mechanical skimming is one of the most widely used and environmentally friendly methods for removing oil from water surfaces. Belt-type oil skimmers have been developed to improve oil recovery rates by utilizing oleophilic materials that attract oil but repel water.

Research on automated skimmer boats has demonstrated the potential of using controller to navigate water surfaces and collect oil efficiently. These systems aim to reduce manual labor and increase operational efficiency.

Another area of research focuses on advanced oil-absorbent materials such as **polyurethane sheet**, which provides high oil absorption capacity and reusability. Modifying sheet surfaces to increase hydrophobic and oleophilic properties can further improve oil separation efficiency.

Design studies also highlight the importance of **hull structure and buoyancy**, which ensure the stability of floating robots operating in dynamic water environments.

These studies demonstrate that combining mechanical skimming mechanisms with automation and improved materials can significantly enhance oil spill cleanup efficiency.

III. METHODOLOGY

The Automated Oil Skimmer Boat is designed using a modular system architecture integrating mechanical, electrical, and control components.

The system consists of the following modules:

1. Floating Hull Structure

The boat is constructed using lightweight and buoyant materials such as PVC or plastic to maintain stability on the water surface.

2. Oil Skimming Mechanism

A conveyor belt o skimmer mechanism is used to collect floating oil. Since oil is less dense than water, it adheres to the oleophilic surface of the belt.

3. Oil Separation and Storage

The collected oil is scraped from the skimmer mechanism and directed into an onboard storage tank where it is separated from water.

4. Control System

A controller FSi6 acts as the control unit. It controls propulsion motors and navigation.

5. Propulsion System

Electric motors and propellers provide movement and maneuverability of the boat.

6. Power Supply

The system is powered by batteries or solar panels to enable long-duration operation.

IV. SYSTEM ARCHITECTURE

The system architecture includes multiple integrated modules:

Mechanical Components

- Floating hull
- Skimmer belt or disk mechanism
- Oil collection tank

Actuation System

- DC motors for propulsion
- Motor drivers

Power System

- Battery supply
- Optional solar panel

Sensors (Optional)

- Obstacle detection sensors
- Oil detection sensors

This architecture enables automated oil detection, navigation, oil collection, and storage.

V. PROCEDURE

The operation of the Automated Oil Skimmer Boat follows several stages:

1. Oil Spill Detection

The system detects oil spills either manually.

2. Boat Deployment

The boat is deployed to the contaminated water area.

3. Navigation

The propulsion system moves the boat toward the oil spill area.

4. Oil Skimming

The conveyor belt skimmer collects oil from the water surface.

5. Oil Storage

The collected oil is stored in an onboard tank.

6. Storage Monitoring

When the tank becomes full, the system returns to the base station.

7. Oil Disposal

The collected oil is pumped or drained for recycling or disposal.

This process continues until the water surface is cleaned.

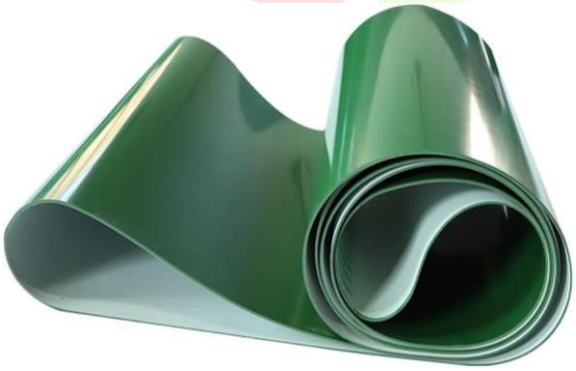
VI. SYSTEM COMPONENTS

The main components used in the system include:

- Buck booster

- fsi6 controller

- pu conveyor belt



- servo

- brushless submersible pump

- 12v-power-window-motor

VII. CONCLUSION

The Automated Oil Skimmer Boat provides an innovative solution for cleaning oil spills from water surfaces. The integration of mechanical skimming mechanisms with microcontroller-based automation enables efficient oil collection while reducing human intervention.

The system is environmentally friendly, cost-effective, and capable of operating in various environments such as rivers, lakes, and harbors. By improving oil recovery efficiency and minimizing ecological damage, this technology can contribute significantly to marine pollution control.

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