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A study on oil spill in ocean

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Abstract: The layer of oil on the water surface due to some accidents in the oceans, like tanker/container blasts or malfunctions of ships, causes oil spills in marine It causes water pollution and puts marine life and human beings at risk. There are various solutions for the oil spill problem. However, most of them require manual operation. According to previous studies and research papers, they used artificial intelligence algorithms and ultrasonic sensor algorithms to capture pictures of the oil spill location and area and differentiate between water, waste, and crude oil. And used Internet of Things (IOT) algorithms for oil skimming, which is a device to absorb the crude oil. During oil skimming, the PH sensors and MQ3 sensors detect the crude oil and display the output on the LCD screen, and the oil skimmers start absorbing oil. The Internet of Things (IoT) and ultrasonic sensor algorithms are considered and reviewed in this study.

Keywords— Artificial intelligence , algorithmas , oil skimming , internet of things ,oil spills , ocean pollution.

I. INTRODUCTION

Marine oil spill is the most typical and serious environmental pollution accident in process of marine development. Various oil spills pollution types on the sea not only damage the marine environment and coastline ecology but also pollute fishery resources endanger marine food security, affect tourism, threaten human health and even hinder the healthy development of marine economy. Once the spilled oil on the sea surface is not removed in time a series of complex physical and chemical changes such as diffusion , drift , emulsification, evaporation,dissolution , adsorption precipitation, photo oxidation and biodegradation will occur under the combined action of wind , wave current and other environmental dynamics forming water in oil and oil in water emulsions of different concentrations.

Types of marine oil spill pollution are closely related to source tracing and pollution disposal which is an important basis for oil spill pollution punishment. Different type of oil products crude oil and its emulsions in different states need to adopt different emergency treatment strategies such as combustion elimination, oil absorption felt adsorption, dispersant spraying, Skimmer, identification of different type of marine oil spill pollution is of great significance for marine oil spilling monitoring and emergency response. synthetic aperture radar (SAR) is the most used technology for marine oil spilling monitoring in Microwave remote sensing which has the advantage of all day, all weather and can also successfully obtain images under cloudy and rainy conditions.

Most of the marine oil spill sensing monitoring of marine oil spill is carried out based on a single sensor type which has certain limitations and cannot meet the needs of accurate monitoring. Attention to combining the advantage of different sensors to effectively improve remote sensing monitoring ability of marine oil spill has made certain achievements.

Most of the marine oil spill sensing monitoring of marine oil spill is carried out based on a single sensor type which has certain limitations and cannot meet the needs of accurate monitoring. Attention to combining the advantage of different sensors to effectively improve remote sensing monitoring ability of marine oil spill has made certain achievements. China GF3 SAR data to delineate suspect oil spill areas in the east China sea. The multispectral data of sentinel -2 satellite is used to carry out optical remote sensing detection of marine oil spill , and further carried out optical remote sensing identification and classification of oil spill types based on the analysis of spectral response characteristics of oil spill simulation experiment which has mutually verified with the suspect oil spill monitoring results of GF3 SAR .Wang LF et al (2021) proposed a new method to determine the oild film area using the fusion of visible light and thermal infra-red images.

This method integrates the advantages of visible light and thermal infrared images and can accurately determine the oil film area under different lighting conditions with an average error of 2.78% .Wang and GAO(2020) used SAR and laser fluorescence sensor to carry out airborne platform oil spill monitoring. First they used SAR for long -distance and large -scale detection . once the suspect oil spill area was detected they used laser fluorescence sensor for close detection. Combination of SAR and laser fluorescent sensor generally improved the detection effect and recognition ability of marine pollutants in large areas

To sum up this paper designed and implemented 2 outdoor oil spill simulation experiments carried out the extraction and analysis of hyperspectral and thermal infrared optical features of different oil spill pollution types. Introduced classification algorithms such as classical machine learning, ensemble learning and deeplearning, studied and constructed hyper spectral oil spill pollution type recognition algorithms and explore how to improve ability of hyperspectral oil spill pollution type identification by adding thermal infrared features.

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II. RELATED WORKS

During recent times there has been several successful algorithms for the oil spill issue.There is a Cloud Based Platform for marine oil spill [2] gives a good visualization of accident through maps and this platforms have certain modules like online map display subsystem, resource management subsystem: to get data and edit the input resource , emergency capability of visualization subsystem: which gives idea about accident and certain calculations to the team. Oil spill trajectory of oil tankers in the inland rivers [3] says that ship accidents are causing pollution to the inland rivers due to the geographical location. the accidents caused great damage to banks so for this thing they invented a monitoring model for oil spills by, using drifting buoys, SAR image processing, and early warning systems based on fluorescence spectroscopy which helps to improve the monitoring of oil spills. The camera recognizes the oil parts but cannot recognize micro parts.

Oil spill pollution identification using RPNET deep learning model and airborne hyperspectralimage [4] shows how to detect the type oil by taking the pictures and shows the pic in different colours every colour represents one type of oil which pollutes the water. explains the approach, which includes gathering data from 3000 photos of pollution in the Persian Gulf and classifying them into four categories: clean water, trash, oil pollution, and urban wastewater. explains data preprocessing techniques like as normalisation and image scaling. explains how a convolutional neural network (CNN) and traditional machine learning methods (such logistic regression, SVM, etc.) are used to train the AI system. explains the three evaluation criteria—Accuracy, Precision, and Recall—that are used to determine how well an AI performs.The oil skimmer[6] mentions how to determine by automating the procedure using sensor-based detection and control mechanisms, the suggested system seeks to improve the effectiveness of cleaning up oil spills. One effective way to remove oil from water surfaces is to use a belt-type oil skimmer. . In paper[7], they proposed a drone-based solution with a deep-learning U-net model. It processes the radar backscattering dominated by the specular component in calm ocean conditions to detect contaminated sea surfaces with oil spills.

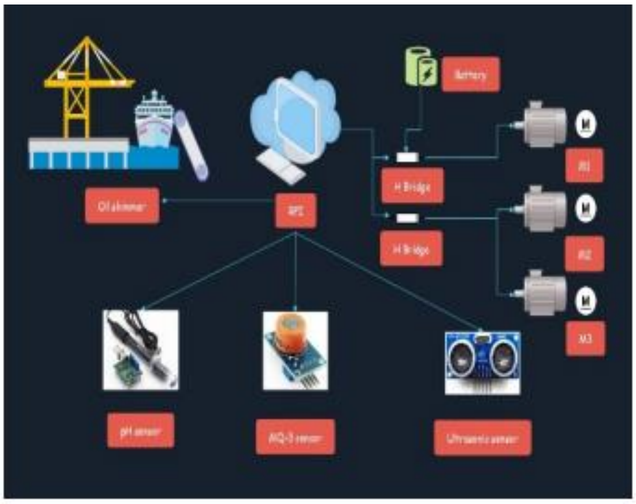

Figure 1. Block diagram of Oil skimming module

In order to effectively produce policies prior to oil spills and make timely response decisions for the use of chemical dispersants[9], a quantitative selection tool was generated in the form of an interactive decision tree that can be used to choose the most effective dispersant delivery technology based on a set of ocean conditions and dispersant application parameter.

III. PROPOSED WORK

In order to achieve the oil spill emergency reaction, oil spill emergency capabilities, and oil spill resource visualization, the platform is built on the B/S (browser/server) framework and includes the tools of Baidu map API and MapV visualization system.In order to provide real-time graphical analysis, the oil spill emergency response platform is built to be cloud-based and integrates GIS, maps, and resource information.

Through the use of QR code input and multi-source intelligence, emergency resource management is effectively managed. Through the use of GPS, AIS, and Baidu Maps, the platform enables dynamic map interactions. By merging resource and geographic data, it makes commanding and coordinating during emergencies easier. The system computes oil spill emergency capabilities and allows for event reporting and assessment. It illustrates each wharf's and each region's capacity while taking equipment delivery time into account. Decision-making is improved by visualization technology, which shows real-time recovery capabilities and equipment accessibility. The platform's overall goal is to maximize oil spill emergency response by using a thorough and effective strategy.In order to avoid oil spilling, a long- and short-term memory network (LSTM) monitoring model for oil spill behavior, together with combination of sparse autoencoder (SAE) to compress the input data and extract more valuable features. The difficulties in keeping an eye on and reacting to oil spill situations in interior rivers, highlighting the shortcomings of the detection techniques used today, like floating buoys and remote sensing. The concept recommends using artificial intelligence—more specifically, neural networks—for dynamic trajectory prediction in order to address these problems.

Fig 5. Oil Spill Monitoring - Working Prototype

Neural networks can determine the drift, diffusion rate, and impact range of an oil spill while providing better real-time performance by continuously learning from available data. Enhancing the system's autonomous perception capability will boost accident monitoring, control, and oil spill recovery in inland waterways while serving as a useful supplementary function for early warning systems.The efficiency of marine oil spill monitoring with hyperspectral remote sensing admits that it can be difficult to correctly identify various light oil types. The study details an outdoor oil spill experiment that collected data on five common oil products using an unmanned aerial hyperspectral imager. In this study, features are extracted, analyzed, and a recognition model named RPnet—which is built on multi-feature fusion and deep learning—is created. By providing essential technical support for offshore oil spill monitoring by pertinent business departments, this model seeks to accurately identify different types of oil spills.

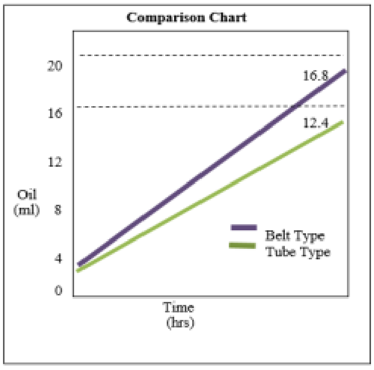

Fig 6. Quantitative analysis concerning Belt type and Tube type Oil skimmer

The passage emphasizes how offshore oil activities can result in marine oil spills, which pose a threat to the environment and call for effective emergency monitoring. The use of hyperspectral remote sensing technology, which provides high-resolution capabilities for precise identification of different types of oil spills, becomes increasingly important. It is difficult to distinguish light oils from dark oils due to the spectral differences in oil films that are caused by molecular vibrations and chemical composition. The paper uses the ability of the RPnet deep learning model to automatically learn deepseated features in order to address this. To improve the identification of various types of oil spills, an outdoor experiment gathers hyperspectral data for five different oil products. In order to increase the effectiveness of hyperspectral remote sensing in identifying and responding to marine oil spills, the research incorporates deep learning algorithms, offering a promising approach for real-time monitoring and pollution management.

The proposal suggests using unmanned robots equipped with a vision system powered by artificial intelligence to quickly and thoroughly identify and categorize marine and coastal pollution[5]. The system, which combines computer vision and machine learning, achieves 98% accuracy and is designed to be used as a vision module in autonomous coastal conservation robots. This strategy should greatly speed up coastal management procedures.

A focal point is the Persian Gulf, which is struggling with increased pollution. The study shows how AI-powered unmanned robots can effectively identify pollutants, providing a workable solution for environmental monitoring. The summary also discusses related research on deep neural networkbased environmental management and various pollution detection techniques. IoT is used to automate an oil skimmer and create an intelligent oil spill cleanup system. The framework consists of an oil skimmer that is connected to a Raspberry Pi 4 and a number of sensors, such as a MQ3 sensor, an ultrasonic sensor, and a pH sensor.

Oil is detected by sensors, and the skimmer starts cleaning. It is difficult to fully recover from hydrocarbon spills in the maritime environment, which result in oil spills. The government of Dubai prioritizes readiness for oil spills and uses ASTM-approved skimmers. Unlike previous attempts at water surface cleaning, the suggested approach combines IoT, automation, and wireless technology for more effective and sensorequipped control of oil spill cleaning.Thermal infrared remote sensing, which uses a thermal imaging camera carried on a UAV, is used to find marine oil spills. A proposed SVC model for marine oil-spill thermal infrared detection exhibits a robust correlation and superior accuracy in identifying thick oil films of varying thicknesses. The UAV experiment shows the potential of UAV thermal infrared remote sensing for oil-spill detection[1] with an overall accuracy exceeding 76.84% and a Kappa coefficient surpassing 0.740. In addition to addressing issues with existing detection techniques and suggesting an outdoor experimental setup for accurate verification, the significance of accurate detection for emergency response and pollution treatment in the marine environment is emphasized.In paper[8] for the problem that oil spill detection scheme based on polarization feature and deep learning has large sample requirements and high information redundancy, they proposed a classification scheme combining with RBFSVM classifier and VGG16 based on transfer network.

A method is proposed[10] for

automatically calculating the contrast based upon the statistical properties of the measured intensity signals from the ocean surface, and shown to work well even for complex slick geometries. The paper[11] discusses the working of a model whose primary objective is to deter birds, fishes and other marine fauna from the affected area with different highly application-specific and configurable modules that improve the existing solutions.

IV.RESEARCH CHALLENGES

The most crucial step in the process is detection since it allows for the achievement of the necessary level of efficiency.Erroneous data might result from inaccurate or incorrectly calibrated sensors, which can affect effective detection.Temperature and humidity levels in the atmosphere can have an impact on how well thermal infrared sensors work.Variations in wind and wave patterns, for example, can affect how easily oil spills can be found.Inadequate ground truth data for validation may jeopardise the accuracy of the findings. False positives—the detection of spills that aren't actually pollution events—or false negatives—the omission of actual pollution events—can be produced by autonomous systems. The coverage and resolution of autonomous systems might be constrained, which could cause them to overlook smaller-scale pollution incidents.It can be difficult to maintain autonomous systems in distant marine environments and ensure their long-term stability. Technologies for monitoring and skimming may not function at their best in adverse conditions, turbulent seas, or unfavourable environmental circumstances.Effectively and selectively extracting oil from the water's surface may provide difficulties for skimming technology, particularly when debris or highly viscous oils are present.Certain technologies could not be easily scalable for largescale oil spill disasters, or they might have substantial operating expenses.Response attempts may be less effective if monitoring and decision support tools are not seamlessly integrated. For deep learning models, like rpnet, to generalise effectively, a significant amount of labelled training data is needed. Insufficient or skewed training data could lead to subpar model performance. Hyperparameters in deep learning models can have a big impact on how well they work. Selecting the wrong hyperparameters might cause either underfitting or overfitting.Pollutant types may be misinterpreted in hyperspectral pictures due to their sensitivity to environmental elements like sunshine, water conditions, and atmospheric impacts.When distinct pollutant kinds are not equally represented in the dataset, biassed models may be created that function well in majority classes but poorly in minority classes. It's possible that models created for one particular inland river won't translate well to other river systems with distinct features.Tanker- specific characteristics like draught, size, and speed can affect how accurately oil leaks from them are predicted, thus this is something to keep in mind.

V.CONCLUSION

The above study say that oil skimmer used to improve the circumstances for aquatic flora and wildlife by eliminating oil spills from the marine environment. Compared to conventional techniques, this automated prototype makes cleanup of oil spills easier and more efficient by utilising a thorough review of the literature. Future improvements will include the ability to use solar panels to power the model for longer periods of time, independent of electricity or battery requirements. To further enhance its application to industrial-level skimming, tests of several skimming modules, including drum and brush kinds, and the integration of a speed controller to adjust to changing conditions are necessary.

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Keep in mind.