International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

FABRICATION OF SOLAR POWERED OIL SKIMMER ROBOT

Nirmal Joshua Mathews [1], Tesbin K Varghese [2], Prince Zachariah [3], Ninos Aji Chirathalattu [4]

[1,2,3,4] *Student, Department of Mechanical Engineering, Saintgits college of engineering, Kerala, India*

Abstract - *Oil Skimmer Robot is a device which can be used for ocean purification by removing the oil from water surface. The system uses a photovoltaic powered conveyor belt to propel itself and collect oil. The flexible conveyor belt softly rolls over the ocean's surface, absorbing oil while deflecting water because of its hydrophobic properties. The photovoltaic cells generate enough electricity to keep the fleet moving for several weeks and provide the energy to propel the vehicles forward. As the head moves through the water the conveyor belt constantly rotates and sucks up pollution. The belt is then compressed to remove the oil. As the clean part of the belt comes out of the head it immediately begins absorbing oil, making the collection process seamless and efficient. This process is more streamlined than current ocean-skimming technologies because the robots can operate autonomously and don't need to return to the shore for constant maintenance*.

Key Words **oil spill, environmental pollution, solar power, oil skimmer, Nano belt, remote control, gear, motor, propeller.**

1. INTRODUCTION

In an era of increasing environmental concern, oil pollution arising either from marine accidents or from routine ship operations (tanker loading and unloading, etc.) is a major threat for the marine environment. Although sea traffic produces minimal disruption to the environment when compared to other modes of transport, maritime transport of oil and other hazardous goods has a higher risk since the consequences of pollution are often catastrophic. The average quantity of ship-generated oil that ends up in the sea exceeds 350,000 tonnes per year. When an oil spill occurs, either in open or confined seas, the ecological damage on the local ecosystem could be huge and irreversible. Birds, sea mammals, fish and several marine invertebrate species are among the groups most impacted, and in some cases the whole food chain is affected. Oil spills can negatively influence the physiology, immunology, and development of some organisms, but their most evident effect is usually an important decrease or disappearance of populations of marine fauna and flora within the affected area. Linked to the damage caused to the environment are the high costs to fisheries, related industries, and tourism in the affected areas.

The efforts in protecting the environment after an oil spill has occurred could cost billions of dollars in clean-up and damage costs and often produce questionable results. For instance, the most expensive oil spill in history is the one caused by Exxon Valdez in Alaska in 1989, where clean-up alone cost about USD2.5 billion and total costs (including fines, penalties and claims settlements) are estimated at USD 9.5 billion. Despite the effort and resources allocated, the clean-up operation had little success and the whole incident led to a major environmental disaster.

While preventive measures may reduce the frequency of spills, it is impossible to avoid accidents. Therefore, effective oil spill response capability is mandatory even if, ideally, only seldom used. To date, the prevailing oil spill countermeasures vary from mechanical and chemical methods, to the use of absorbents, oil burning and bioremediation. Often, depending on the prevailing spill conditions, a combination of these methods is used to ensure effective response.

Mechanical clean-up refers to the use of booms and skimmers. Booms are used to confine the oil to a specific area, hence controlling its spreading, and/or stop the oil from entering a given area, while skimmers are used to recover the oil from the water surface. Mechanical methods are the most widely used combating means. Each recovery operation may involve two or more large ships, trained personnel, hundreds of meters of boom, advanced skimming systems, pumping equipment, temporary storage devices and disposal systems. Mechanical recovery operations for large spills are in general considered to be expensive, complex and labour-intensive with their recovery efficiency not to usually exceed 20%.

The chemical methods are based on the transformation of the physicochemical properties of the oil. The most common method is the use of dispersants. These are surfactants dissolved in one or more solvents that are sprayed onto oil slicks. The interfacial tension between the oil and water is reduced, thus promoting the formation of oil droplets. Even those oils which can be dispersed initially, become resistant after a period of time as the viscosity increases due to evaporation and emulsification. Although dispersants, when properly applied, are more efficient than skimmers, for large spills can also be expensive, complex and labour-intensive.

Here, the oil is recovered using a conveyer belt. Each Sea swarm robot is comprised of a head, which is covered by a layer of photovoltaic cells, and a Nano wire covered conveyor belt. The photovoltaic cells generate enough electricity to keep the fleet moving for several weeks and provide the energy to propel the vehicles forward. As the head moves through the water the conveyor belt constantly rotates and sucks up pollution. The Nano wire-covered belt

is then compressed to remove the oil. As the clean part of the belt comes out of the head it immediately begins absorbing oil, making the collection process seamless and efficient.
This process is more streamlined than current ocean-skimming technologies because the robots can operate autonomously and don't need to return to the shore for constant maintenance. As the vehicles work in unison they can cover large areas and by communicating with each other and researchers on land, they can coordinate their collection efforts. Measuring just 16 feet long by seven feet wide, the fleet can access hard to reach places like coastlines and estuaries.

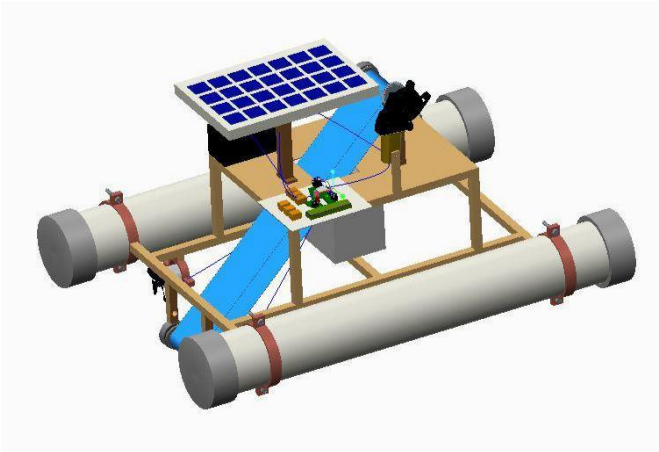
2. METHODOLOGY

As shown in the figure below, each robot is comprised

of a head, which is covered by a layer of photovoltaic cells, and an oil absorbing fabric covered conveyor belt. The photovoltaic cells generate enough electricity to keep the fleet moving for several weeks and provide the energy to propel the vehicles forward.

As the head moves through the water the conveyor belt constantly rotates and sucks up pollution. The fabric-covered belt is then compressed to remove the oil. As the clean part of the belt comes out of the head it immediately begins absorbing oil, making the collection process seamless and efficient.

This process is more streamlined than current ocean-skimming technologies because the robots can operate autonomously and don't need to return to the shore for constant maintenance. As the vehicles work in unison they can cover large areas and by communicating with each other and researchers on land. Measuring just 16 feet long by seven feet wide, the fleet can access hard to reach places like coastlines and estuaries.



Before deploying, the working of the motors and the electronic circuit was tested. The battery was charged using solar power. The equipment was then deployed in a water body and the forward and sideways motions were tested. The running of the oil skimming belt and its oil skimming capability was also evaluated.

3. RESULTS AND DISCUSSIONS

It can be very effectively used for skimming away oil spills from the surface of oceans. The deep water horizon rig regions can use the Sea swarm in case of accidents. It can also be used in oil refineries near to oceans or any other industries which dispose chemicals and other waste oils to the rivers nearby.

4. CONCLUSIONS

By using Wi-Fi or mobile technology, the entire mechanism can be automated. The driving mechanism is based on solar energy so problems related to its fuelling can be completely omitted and is a renewable source. Use of Nano fibre belts could improve the efficiency of system. This paper has proposed the autonomous distributed system/ robotic swarms as a novel concept for efficient oil spill confrontation. Instead of using a single robot, if a large no of oil skimmers are fabricated then it will have high autonomy that recover oil mechanically and are able to collect and share information with each other. The multi-unit/co-operative behaviour approach provides a more environmentally friendly, efficient, versatile and fault-tolerant means for oil spill elimination. This artificial intelligence concept is generic for marine pollution elimination; for example, its application could be easily extended for port refuse collection. The swarm recovery has been integrated in a mathematical description of the dynamics of spreading and weathering of an oil spill. Simulations of this model signify the increased efficiency and the potential of the concept.

ACKNOWLEDGEMENT

First and foremost, we thankfully acknowledge our principal Dr. M.D. Mathew for giving us with an opportunity to carry out this project.

The constant encouragement and timely support rendered by our head of department, Dr. Jacob T Varghese is deeply remembered.

We express our heartfelt gratitude to our seminar guide, Er. Davis Wilson, assistant professor, department of mechanical engineering, for his valuable guidance, support and encouragement during the course of the project and in the preparation of the report. We have greatly benefited from his experience and knowledge.

The help extended by our project co-ordinator Er. Vineeth V K, Assistant Professor, Department of Mechanical Engineering, and all other staff members of the department are remembered with gratitude.

The prayers and blessings of our parents and family members always helped us to overcome all difficulties.

We also remember with thanks to all our friends and well-wishers for their encouragement and support.

Above all, we would like to express our profound gratitude to God Almighty for his immense blessings upon us that led to the successful completion of this project.

REFERENCES

1. **Abdul Azeez Al Majeed (2011)** The use of palm fibre in conveyer of oil skimmers. Journal of environment management 2012.

2. **Nikolas M.P Kakkalas (2007)** Robotic swarm concept for oil spill confrontation. Journal of hazardous materials, October 2007.

BIOGRAPHIES

Author-1,
Nirmal Joshua Mathews, Department of Mechanical Engineering,
Saintgits College of Engineering.

Author-2,
Tesbin K Varghese, Department of Mechanical Engineering,
Saintgits College of Engineering

Author-3,
Prince Zachariah, Department of Mechanical Engineering,
Saintgits College of Engineering.

Author-4,
Ninos Aji Chirathalattu, Department of Mechanical Engineering,
Saintgits College Of Engineering.